Service Reference Guide

HP Compaq dx2810 Microtower
HP Compaq dx2810 Special Edition Microtower
HP Compaq dx2818 Microtower
HP Compaq dx2810 Small Form Factor
Business PCs

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Service Reference Guide

Business PCs

Third Edition (June 2009)

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About This Book

⚠ **WARNING!** Text set off in this manner indicates that failure to follow directions could result in bodily harm or loss of life.

⚠ **CAUTION:** Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

NOTE: Text set off in this manner provides important supplemental information.

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1 Product Features

Front Panel Components

Drive configuration may vary by model.

Figure 1-1 dx2810 Front Panel Components

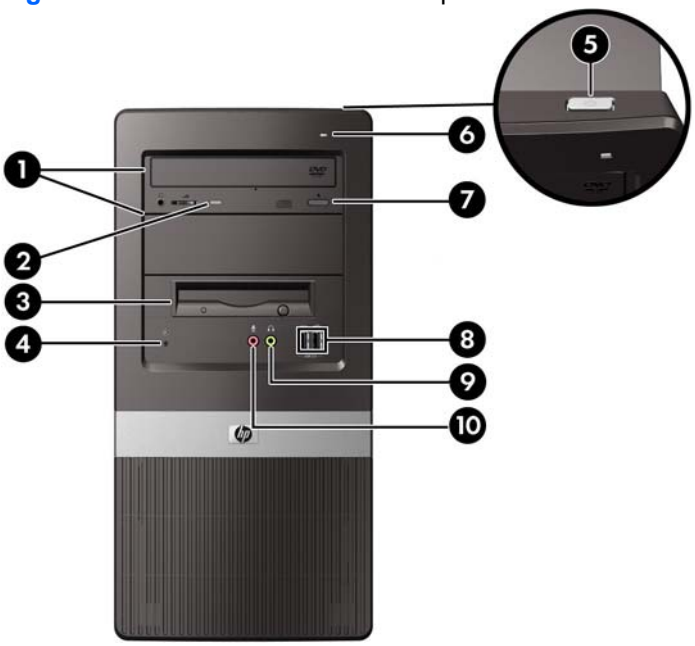


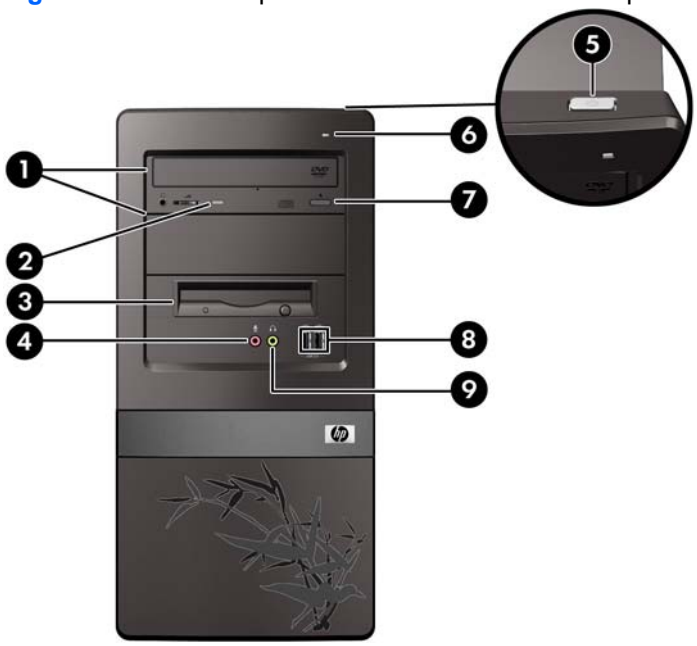
Table 1-1 dx2810 Front Panel Components

1	5.25-inch Optical Drives[1]	6	Hard Drive Activity Light
2	Optical Drive Activity Light	7	Optical Drive Eject Button
3	Diskette Drive (optional)[2]	8	USB (Universal Serial Bus) 2.0 Ports
4	Reset/Recovery Button	9	Headphone Connector
5	Dual-State Power Button	10	Microphone Connector

[1] Some models have bezel blanks covering one or both of the 5.25-inch drive bays.

[2] Some models have a bezel blank covering the 3.5-inch drive bay.

Figure 1-2 dx2810 Special Edition Front Panel Components



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Rear Panel Components

Figure 1-3 dx2810 Rear Panel Components

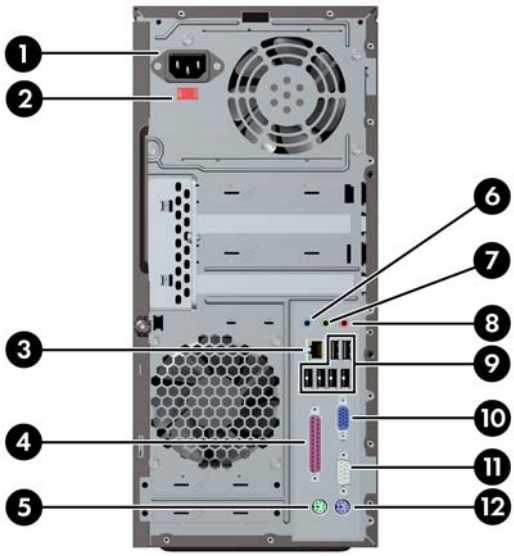

Table 1-3 dx2810 Rear Panel Components

1	Power Cord Connector	7	Line-Out Connector for powered audio devices (green)
2	Voltage Select Switch	8	Microphone Connector (pink)
3	RJ-45 Network Connector	9	Universal Serial Bus (USB) Ports
4	Parallel Port (purple)	10	VGA Monitor Connector (blue)
5	PS/2 Mouse Connector (green)	11	Serial Port (teal)
6	Line-In Audio Connector (blue)	12	PS/2 Keyboard Connector (purple)

NOTE: Arrangement and number of connectors may vary by model.

The monitor connector on the system board is inactive when a PCI Express x16 graphics card is installed in the computer.

If a PCI Express x1 graphics card is installed, the connectors on the card and the system board may be used at the same time. Some settings may need to be changed in Computer Setup to use both connectors. For information about setting the boot VGA controller, refer to the *Computer Setup (F10) Utility Guide*.

Figure 1-4 dx2810 Special Edition Rear Panel Components

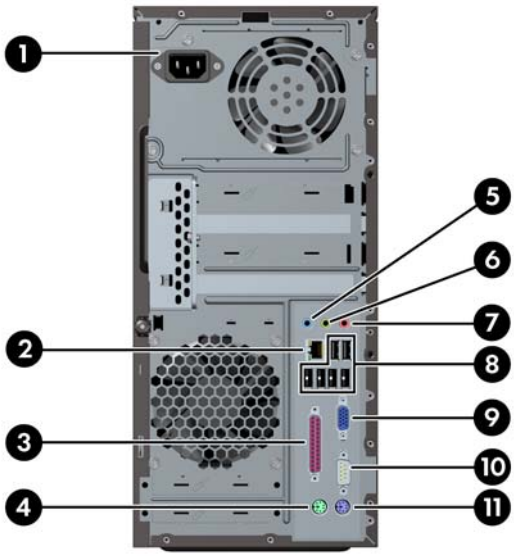

Table 1-4 dx2810 Special Edition Rear Panel Components

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4	PS/2 Mouse Connector (green)	10	Serial Port (teal)
5	Line-In Audio Connector (blue)	11	PS/2 Keyboard Connector (purple)
6	Line-Out Connector for powered audio devices (green)		

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Keyboard

Figure 1-5 Keyboard Components

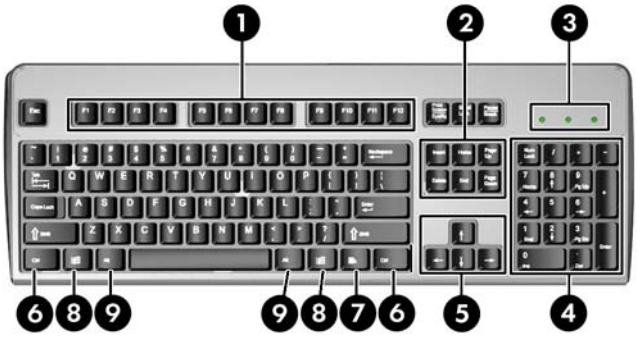


Table 1-5 Keyboard Components

1	Function Keys	Perform special functions depending on the software application being used.
2	Editing Keys	Include the following: Insert, Home, Page Up, Delete, End, and Page Down.
3	Status Lights	Indicate the status of the computer and keyboard settings (Num Lock, Caps Lock, and Scroll Lock).
4	Numeric Keys	Work like a calculator keypad.
5	Arrow Keys	Used to navigate through a document or Web site. These keys allow you to move left, right, up, and down, using the keyboard instead of the mouse.
6	Ctrl Keys	Used in combination with another key; their effect depends on the application software you are using.
7	Application Key[1]	Used (like the right mouse button) to open pop-up menus in a Microsoft Office application. May perform other functions in other software applications.
8	Windows Logo Keys[1]	Used to open the Start menu in Microsoft Windows. Used in combination with other keys to perform other functions.
9	Alt Keys	Used in combination with another key; their effect depends on the application software you are using.

[1] Keys available in select geographic regions.

Using the Windows Logo Key

Use the Windows Logo key in combination with other keys to perform certain functions available in the Windows operating system. Refer to Keyboard on page 5 to identify the Windows Logo key.

Table 1-6 Windows Logo Key Functions

The following Windows Logo Key functions are available in Microsoft Windows XP and Microsoft Windows Vista.	
Windows Logo Key	Displays or hides the Start menu
Windows Logo Key + d	Displays the Desktop
Windows Logo Key + m	Minimizes all open applications
Shift + Windows Logo Key + m	Undoes Minimize All
Windows Logo Key + e	Launches My Computer
Windows Logo Key + f	Launches Find Document
Windows Logo Key + Ctrl + f	Launches Find Computer
Windows Logo Key + F1	Launches Windows Help
Windows Logo Key + l	Locks the computer if you are connected to a network domain, or allows you to switch users if you are not connected to a network domain
Windows Logo Key + r	Launches the Run dialog box
Windows Logo Key + u	Launches the Utility Manager
Windows Logo Key + Pause/Break	Launches the System Properties dialog box
Windows Logo Key + Tab	Windows XP - Cycles through the Taskbar buttons Windows Vista - Cycles through programs on the Taskbar using the Windows Flip 3-D
In addition to the Windows Logo Key functions described above, the following functions are also available in Microsoft Windows Vista.	
Ctrl + Windows Logo Key + Tab	Use the arrow keys to cycle through programs on the Taskbar by using Windows Flip 3-D
Windows Logo Key + Spacebar	Brings all gadgets to the front and select Windows Sidebar
Windows Logo Key + g	Cycles through Sidebar gadgets
Windows Logo Key + u	Launches Ease of Access Center
Windows Logo Key + any number key	Launches the Quick Launch shortcut that is in the position that corresponds to the number (for example, Windows Logo Key + 1 launches the first shortcut in the Quick Launch menu)

Serial Number Location

Each computer has a unique serial number and product ID number that are located on the top of the computer. Keep these numbers available for use when contacting customer service for assistance.

Figure 1-6 Serial Number and Product ID Location

2 Installing and Customizing the Software

NOTE: If the computer was shipped with Windows Vista loaded, you will be prompted to register the computer with HP Total Care before installing the operating system. You will see a brief movie followed by an online registration form. Fill out the form, click the **Begin** button, and follow the instructions on the screen.

CAUTION: Do not add optional hardware or third-party devices to the computer until the operating system is successfully installed. Doing so may cause errors and prevent the operating system from installing properly.

Installing the Operating System

The first time you turn on the computer, the operating system is installed automatically. This process takes about 5 to 10 minutes, depending on which operating system is being installed. Carefully read and follow the instructions on the screen to complete the installation.

CAUTION: Once the automatic installation has begun, DO NOT TURN OFF THE COMPUTER UNTIL THE PROCESS IS COMPLETE. Turning off the computer during the installation process may damage the software that runs the computer or prevent its proper installation.

NOTE: If the computer shipped with more than one operating system language on the hard drive, the installation process could take up to 60 minutes.

If your computer was not shipped with a Microsoft operating system, some portions of this documentation do not apply. Additional information is available in online help after you install the operating system.

Installing or Upgrading Device Drivers

When installing optional hardware devices after the operating system installation is complete, you must also install the drivers for each of the devices.

If prompted for the i386 directory, replace the path specification with `C:\i386`, or use the **Browse** button in the dialog box to locate the i386 folder. This action points the operating system to the appropriate drivers.

Obtain the latest support software, including support software for the operating system from http://www.hp.com/support. Select your country and language, select **Download drivers and software (and firmware)**, enter the model number of the computer, and press Enter.

HP Backup and Recovery Manager

The HP Backup and Recovery Manager is an easy-to-use, versatile application that allows you to back up and recover the primary hard drive on the PC. The application works within Windows to create

backups of Windows, all applications, and all data files. Backups can be scheduled to occur automatically at designated intervals, or they can be initiated manually. Important files can be archived separately from regular backups.

HP Backup and Recovery Manager is preinstalled on the C: drive and creates a Recovery Partition.

Recovery Points and file backups can be copied to CD or DVD discs, while all backups can be copied to network or secondary hard disks.

HP highly recommends that you create a Recovery Disc Set immediately before using the computer and schedule regular automatic Recovery Point backups.

To create the Recovery Disc Set:

1. Click **Start** > **HP Backup and Recovery** > **HP Backup and Recovery Manager** to open the Backup and Recovery Wizard, then click **Next**.
2. Select **Create a set of recovery discs (Recommended)** and click **Next**.
3. Follow the instructions in the wizard.

For more information on using HP Backup and Recovery Manager, refer to the *HP Backup and Recovery Manager User Guide* by selecting **Start** > **HP Backup and Recovery** > **HP Backup and Recovery Manager Manual**.

NOTE: You can order a Recovery Disc Set from HP by calling the HP support center. Go to the following Web site, select your region, and click the **Technical support after you buy** link under the **Call HP** heading to obtain the support center telephone number for your region.

http://welcome.hp.com/country/us/en/wwcontact_us.html

3 Computer Setup (F10) Utility

Computer Setup (F10) Utilities

Use Computer Setup (F10) Utility to do the following:

- Change factory default settings.
- Set the system date and time.
- Set, view, change, or verify the system configuration, including settings for graphics, audio, storage, communications, and input devices.
- View settings for processor and memory.
- Modify the boot order of bootable devices such as hard drives, diskette drives, optical drives, or USB flash media devices.
- Run hard drive self-tests.
- Establish a supervisor password that controls access to Computer Setup (F10) Utility and the settings described in this section.

Using Computer Setup (F10) Utilities

Computer Setup can be accessed only by turning the computer on or restarting the system. To access the Computer Setup Utilities menu, complete the following steps:

1. Turn on or restart the computer.
2. As soon as the computer is turned on, press F10 when the monitor light turns green to enter Computer Setup.

NOTE: If you do not press F10 at the appropriate time, you must restart the computer and again press F10 when the monitor light turns green to access the utility.

3. The Computer Setup Utility screen is divided into menu headings and actions.

   Five menu headings appear on the Computer Setup Utility screen:

   - Main
   - Advanced
   - Power
   - Boot
   - Exit

Use the arrow keys to select the appropriate heading, then press Enter. Use the arrow (up and down) keys to select the option you want, then press Enter. To return to the previous screen, press Esc.

△ **CAUTION:** Do NOT turn the computer power OFF while the ROM is saving the Computer Setup (F10) changes because the CMOS could become corrupted. It is safe to turn off the computer only after exiting the F10 Setup screen.

Computer Setup—Main

NOTE: Support for specific Computer Setup options may vary depending on the hardware configuration.

Table 3-1 Computer Setup—Main

Option	Description
System Time	Allows you to set system time.
System Date	Allows you to set system date.
Floppy Diskette A:	Allows you to set drive A to: • Disabled • 1.44 MB 3.5” • Not Installed

Table 3-1 Computer Setup—Main (continued)

1st Drive
2nd Drive
3rd Drive
4th Drive
	For each, allows you to:
	• (view only)
	  ◦ Capacity (Size - HDD only)
	  ◦ Transfer Mode
	• Smart Support - run HDD self-test for selected channel:
	  ◦ SMART Status Check
	  ◦ SMART Short Self-Test
	  ◦ SMART Extended Self-Test

System Information	(view only) • CPU Type • CPU Speed • Cache RAM • Installed Memory • Memory Bank 1 • Memory Bank 2 • Memory Bank 3 • Memory Bank 4 • BIOS Revision • Core Version • Product Name • Product Number • Serial Number • UUID • Asset Tag (press Enter to change)

Computer Setup—Advanced

NOTE: Support for specific Computer Setup options may vary depending on the hardware configuration.

WARNING! Setting items on this menu to incorrect values may cause your system to malfunction.

Table 3-2 Computer Setup—Advanced

Option	Description
Primary Video Adapter	Allows you to select the boot display device when more than 2 video options are offered by the system: • Onboard • PCI-Ex16

Table 3-2 Computer Setup—Advanced (continued)

PS/2 Mouse	Allows you to set: • Disabled • Enabled • Auto Detect
Internal Speaker	Allows you to set the internal speaker to: • Disabled • Enabled
Supervisor Password	Allows you to change supervisor password.
User Password	Allows you to change the user password.
Change Supervisor Password	Allows you to change the supervisor password.
Power On Password	Allows you to disable/enable the Power On Password.
Onboard Video Memory Size	• 128MB • 256MB • 512MB
SATA1 Controller	Allows you to disable/enable the SATA1 Controller.
SATA1 Controller Mode	If SATA1 Controller is enabled, allows you to set the mode to: • IDE • RAID • AHCI
Onboard Audio	Allows you to set the onboard audio to: • Enabled • Disabled • Auto
Onboard LAN	Allows you to disable/enable onboard LAN controller.
Onboard LAN Boot ROM	Allows you to disable/enable the boot ROM of the onboard LAN chip.
USB Ports	Allows you to disable/enable USB ports. • Disabled • Enabled
Hood Sensor	Allows you to disable/enable the hood sensor warning beep.
IO Device Configuration	Allows you to change the Super IO device resource.

Computer Setup—Power

NOTE: Support for specific Computer Setup options may vary depending on the hardware configuration.

Table 3-3 Computer Setup—Power

Option	Description
After AC Power Failure	Allows you to select system restart behavior after power loss: • Stay Off • Power On • Auto
XD	Disables/enables XD bit.
Virtualization Technology	Allows you to disable/enable Virtualization Technology.

Computer Setup—Boot

NOTE: Support for specific Computer Setup options may vary depending on the hardware configuration.

Table 3-4 Computer Setup—Boot

Option	Description
Boot-time Diagnostic Screen	Disables/enables POST diagnostic messages display.
F9: Boot Menu	Allows you to disable/enable Boot Menu.
F10: Setup	Allows you to disable/enable BIOS Setup utility.
F11: Recovery	Allows you to disable/enable HP Backup and Recovery.
F12: Boot from LAN	Allows you to disable/enable PXE boot.
(Boot Device Priority)	Allows you to specify which device groups will boot first, second, third, and fourth or to disable any of the four:
1st Boot Device	• Floppy Group
2nd Boot Device	• CD-ROM Group
3rd Boot Device	• Hard Drive Group
4th Boot Device	• Network Boot Group
	NOTE: MS-DOS drive lettering assignments may not apply after a non-MS-DOS operating system has started.
Floppy Group Boot Priority	Specifies boot device priority within removable devices.
CD-ROM Group Boot Priority	Specifies boot device priority within CD/DVD drives.
Hard Drive Group Boot Priority	Specifies boot device priority within hard drives.
Network Group Boot Priority	Specifies boot device priority within bootable network devices.

Computer Setup—Exit

NOTE: Support for specific Computer Setup options may vary depending on the hardware configuration.

Table 3-5 Computer Setup—Exit

Option	Description
Exit Saving Changes	Press Enter to exit saving changes.
Exit Discarding Changes	Press Enter to exit discarding changes.
Load Setup Defaults	Press Enter to load setup defaults.
Discard Changes	Press Enter to discard changes.
Save Changes	Press Enter to save changes.

Recovering the Configuration Settings

To reset all BIOS Setup options to their default values (including options for ctrl+F10), you must enter F10 Setup mode and press F5.

This does not include updates to **system date**, **system time**, **supervisor password**, **user password**, and **CPU frequency multiplier**.

4 Computer Diagnostic Features

HP Insight Diagnostics

NOTE: HP Insight Diagnostics is included on CD with some computer models only.

The HP Insight Diagnostics utility allows you to view information about the hardware configuration of the computer and perform hardware diagnostic tests on the subsystems of the computer. The utility simplifies the process of effectively identifying, diagnosing, and isolating hardware issues.

The Survey tab is displayed when you invoke HP Insight Diagnostics. This tab shows the current configuration of the computer. From the Survey tab, there is access to several categories of information about the computer. Other tabs provide additional information, including diagnostic test options and test results. The information in each screen of the utility can be saved as an html file and stored on a diskette or USB flash drive.

Use HP Insight Diagnostics to determine if all the devices installed on the computer are recognized by the system and functioning properly. Running tests is optional but recommended after installing or connecting a new device.

You should run tests, save the test results, and print them so that you have printed reports available before placing a call to the Customer Support Center.

NOTE: Third party devices may not be detected by HP Insight Diagnostics.

Accessing HP Insight Diagnostics

You must boot to the *Documentation and Diagnostics* DVD, as described in the steps below, to access HP Insight Diagnostics.

1. While the computer is on, insert the *Documentation and Diagnostics* DVD into an optical drive on the computer.
2. Shut down the operating system and turn off the computer.
3. Turn on the computer. The system will boot to the DVD.

   NOTE: If the system does not boot to the DVD in the optical drive, you may need to change the boot order in the Computer Setup (F10) utility so that the system attempts to boot to the optical drive before booting to the hard drive. Refer to the *Computer Setup (F10) Utility Guide* on the *Documentation and Diagnostics* DVD for more information.

   You can also change the boot order so that the system boots to the optical drive on a one-time basis by pressing the Esc key at startup.

4. Select the appropriate language and click **Continue**.

NOTE: It is recommended that you accept the assigned default keyboard for your language unless you want to test your specific keyboard.

5. In the End User License Agreement page, click **Agree** if you agree with the terms. The HP Insight Diagnostics utility launches with the Survey tab displayed.

Survey Tab

The **Survey** tab displays important system configuration information.

In the **View level** field, you can select the **Summary** view to see limited configuration data or select the **Advanced** view to see all the data in the selected category.

In the **Category** field, you can select the following categories of information to display:

All—Gives a listing of all categories of information about the computer.

Overview—Gives you a listing of general information about the computer.

Architecture—Provides system BIOS and PCI device information.

Asset Control—Shows product name, asset tag, system serial number, and processor information.

Communication—Shows information about the computer parallel (LPT) and serial (COM) port settings, plus USB and network controller information.

Graphics—Shows information about the graphics controller of the computer.

Input Devices—Shows information about the keyboard, mouse, and other input devices connected to the computer.

Memory—Shows information about all memory in the computer. This includes memory slots on the system board and any memory modules installed.

Miscellaneous—Shows HP Insight Diagnostics version information, computer configuration memory (CMOS) information, system board data, and system management BIOS data.

Storage—Shows information about storage media connected to the computer. This list includes all fixed disks, diskette drives, and optical drives.

System—Shows information about the computer model, processor, chassis, and BIOS, plus internal speaker and PCI bus information.

Diagnose Tab

NOTE: The **Diagnose** tab is only available in HP Insight Diagnostics Online Edition.

The Diagnosis feature of the HP Insight Diagnostics Online Edition enables high system availability by performing various non-intrusive, in-depth system and component checks while the operating system is up and running.

There are two types of diagnosis on the **Diagnose** tab: **Smart Array Drive Diagnosis** and **Power Supply Diagnosis**.

The Power Supply Diagnosis allows you to assess the health of select power supply models.

Smart Array Drive Diagnosis is the premier feature of hardware diagnosis and it provides the ability to assess the health of hard disk drives attached to Smart Array controllers and select Modular Smart Array (MSA) products. The Smart Array Drive Diagnosis supports SCSI, serial Advanced Technology

Attachment (SATA), and serial attached SCSI (SAS) disk drives that are attached to Smart Array controllers and select MSA controllers configured as part of a logical volume. To determine the health of a hard disk drive, Diagnosis looks at operational history provided by the hard disk drive and proprietary information provided by the Smart Array controller or the MSA controller. HP has found through experience that looking at operational history is one of the best ways to diagnose disk drive problems.

Systems Insight Manager (SIM) and Diagnosis are now the only tools that can be used to qualify the replacement of defective disk drives under pre-failure warranty.

The Smart Array Drive Diagnosis feature should be used:

- To determine if a disk drive in a fault mode should be replaced.
- When Systems Insight Manager reports that a disk drive has failed.
- When there is data corruption or storage related problems but there are no error LEDs or error messages.
- When there are inconsistent, intermittent, or repeated disk drive failures.
- To determine the health of a logical volume.

NOTE: Smart Array Drive Diagnosis has the unique capability of identifying multiple disk drives in a single volume that are functioning normally, but should be replaced.

To diagnose a logical volume:

1. Click the **Diagnose** tab.
2. Under **Smart Array Drive Diagnosis**, click **+** to expand Storage.
3. Select the logical volumes to diagnose and click the **Diagnose** button.
4. The test status of the logical volumes selected will be displayed on the **Status** tab when Diagnosis has completed.

Test Tab

The Test tab allows you to choose various parts of the system to test. You can also choose the type of test and testing mode.

There are three types of tests to choose from:

- **Quick Test**—Provides a predetermined script where a sample of each hardware component is exercised and requires no user intervention in either Unattended or Interactive mode.
- **Complete Test**—Provides a predetermined script where each hardware component is fully tested. There are more tests available in the Interactive mode, but these require user intervention.
- **Custom Test**—Provides the most flexibility in controlling the testing of a system. The Custom Test mode allows you to specifically select which devices, tests, and test parameters are run.

For each test type, there are two test modes to choose from:

- **Interactive Mode**—Provides maximum control over the testing process. The diagnostic software will prompt you for input during tests that require your interaction. You may also determine whether the test passed or failed.
- **Unattended Mode**—Does not display prompts and requires no interaction. If errors are found, they are displayed when testing is complete.

To begin testing:

1. Select the Test tab.
2. Select the tab for the type of test you want to run: **Quick**, **Complete**, or **Custom**.
3. Select the **Test Mode**: **Interactive** or **Unattended**.
4. Choose how you want the test to be executed, either **Number of Loops** or **Total Test Time**. When choosing to run the test over a specified number of loops, enter the number of loops to perform. If you desire to have the diagnostic test for a specified time period, enter the amount of time in minutes.
5. If performing a Quick Test or Complete Test, select the device to be tested from the drop-down list. If performing a Custom Test, Click the **Expand** button and select the devices to be tested or click the **Check All** button to select all devices.
6. Click the **Begin Testing** button at the bottom right corner of the screen to start the test. The Status tab, which allows you to monitor the progress of the test, is automatically displayed during the testing process. When the test is complete, the Status tab shows whether the device passed or failed.
7. If errors are found, go to the Log tab and click the **Error Log** to display more detailed information and recommended actions.

Status Tab

The Status tab displays the status of the selected tests. The type of test executed (**Quick**, **Complete**, or **Custom**) is also displayed. The main progress bar displays the percent complete of the current set of tests. While testing is in progress, a **Cancel Testing** button is displayed for use if you want to cancel the test.

After testing has completed, the **Cancel Testing** button is replaced with a **Retest** button. The **Retest** button will retest the last set of tests executed. This enables you to re-run the set of tests without having to re-enter the data in the Test tab.

The Status tab also shows:

- The devices being tested
- The test status (running, passed, or failed) of each device being tested
- The overall test progress of all devices being tested
- The test progress for each device being tested
- The elapsed test times for each device being tested

Log Tab

The Log tab contains a **Test Log** tab and an **Error Log** tab.

The **Test Log** displays all tests that have been executed, the number of times of execution, the number of times failed, and the time it took to complete each test. The **Clear Test Log** button will clear the contents of the **Test Log**.

The **Error Log** displays the tests for devices that have failed during the diagnostic testing and includes the following columns of information.

- The **Device** section displays the device tested.
- The **Test** section displays the type of test run.
- The **Description** section describes the error that the diagnostic test found.
- The **Recommended Repair** will give a recommended action that should be performed to resolve the failed hardware.
- The **Failed Count** is the number of times the device has failed a test.
- The **Error Code** provides a numerical code for the failure. The error codes are defined in the Help tab.

The **Clear Error Log** button will clear the contents of the Error Log.

Help Tab

On the Help tab contains an **HP Insight Diagnostics** tab, an **Error Codes** tab, and a **Test Components** tab.

The **HP Insight Diagnostics** tab contains help topics and includes search and index features.

The **Error Codes** tab provides a description of each numerical error code that may appear in the **Error Log** tab located on the **Log** tab. Each code has a corresponding error **Message** and a **Recommended Repair** action that should help solve the problem. To find an error code description quickly, enter the code in the box at the top of the tab and click the **Find Error Codes** button.

The **Test Components** tab displays low-level information on tests that are run.

Saving and Printing Information in HP Insight Diagnostics

You can save the information displayed in the HP Insight Diagnostics **Survey** and **Log** tabs to a USB 2.0 flash drive (64MB or higher). You can not save to the hard drive. The system will automatically create an html file that has the same appearance as the information displayed on the screen.

1. Insert a USB 2.0 flash drive (capacity must be 64MB or higher). USB 1.0 flash drives are not supported.
2. Click **Save** in the bottom right corner of the screen.
3. Select **Save to the floppy** or **Save to USB key**.
4. Enter a file name in the **File Name** box and click the **Save** button. An html file will be saved to the inserted USB flash drive.

NOTE: Do not remove the USB key until you see a message indicating that the html file has been written to the media.

5. Print the information from the storage device used to save it.

NOTE: To exit HP Insight Diagnostics, click the **Exit Diagnostics** button in the bottom left corner of the screen then remove the *Documentation and Diagnostics* DVD from the optical drive.

Downloading the Latest Version of HP Insight Diagnostics

1. Go to http://www.hp.com.
2. Click the **Software & Driver Downloads** link.
3. Enter your product number (for example, dx2810) in the text box and press the Enter key.
4. Select your specific computer model.
5. Select your OS.
6. Click the **Diagnostic** link.
7. Click **HP Insight Diagnostics Offline Edition**.
8. Select a language and click **Download**.

NOTE: The download includes instructions on how to create the bootable CD.

Protecting the Software

To protect software from loss or damage, you should keep a backup copy of all system software, applications, and related files stored on the hard drive. See the operating system or backup utility documentation for instructions on making backup copies of data files.

HP Backup and Recovery Manager

The HP Backup and Recovery Manager is an easy-to-use, versatile application that allows you to back up and recover the primary hard drive on the PC. The application works within Windows to create backups of Windows, all applications, and all data files. Backups can be scheduled to occur automatically at designated intervals, or they can be initiated manually. Important files can be archived separately from regular backups.

HP Backup and Recovery Manager is preinstalled on the C: drive and creates a Recovery Partition.

Recovery Points and file backups can be copied to CD or DVD discs, while all backups can be copied to network or secondary hard disks.

HP highly recommends that you create a Recovery Disc Set immediately before using the computer and schedule regular automatic Recovery Point backups.

To create the Recovery Disc Set:

1. Click **Start** > **HP Backup and Recovery** > **HP Backup and Recovery Manager** to open the Backup and Recovery Wizard, then click **Next**.
2. Select **Create a set of recovery discs (Recommended)** and click **Next**.
3. Follow the instructions in the wizard.

For more information on using HP Backup and Recovery Manager, refer to the *HP Backup and Recovery Manager User Guide* by selecting **Start** > **HP Backup and Recovery** > **HP Backup and Recovery Manager Manual**.

NOTE: You can order a Recovery Disc Set from HP by calling the HP support center. Go to the following Web site, select your region, and click the **Technical support after you buy** link under the **Call HP** heading to obtain the support center telephone number for your region.

http://welcome.hp.com/country/us/en/wwcontact_us.html

5 Serial ATA (SATA) Drive Guidelines and Features

NOTE: HP only supports the use of SATA hard drives on these models of computer. No Parallel ATA (PATA) drives are supported.

SATA Hard Drives

Serial ATA Hard Drive Characteristics	
Number of pins/conductors in data cable	7/7
Number of pins in power cable	15
Maximum data cable length	39.37 in (100 cm)
Data interface voltage differential	400-700 mV
Drive voltages	3.3 V, 5 V, 12 V
Jumpers for configuring drive	N/A
Data transfer rate	3.0 Gb/s

SATA Hard Drive Cables

SATA Data Cable

Always use an HP approved SATA 3.0 Gb/s cable as it is fully backwards compatible with the SATA 1.5 Gb/s drives.

Current HP desktop products ship with SATA 3.0 Gb/s hard drives.

SATA data cables are susceptible to damage if overflexed. Never crease a SATA data cable and never bend it tighter than a 30 mm (1.18 in) radius.

The SATA data cable is a thin, 7-pin cable designed to transmit data for only a single drive.

SMART ATA Drives

The Self Monitoring Analysis and Recording Technology (SMART) ATA drives for the HP Personal Computers have built-in drive failure prediction that warns the user or network administrator of an impending failure or crash of the hard drive. The SMART drive tracks fault prediction and failure indication parameters such as reallocated sector count, spin retry count, and calibration retry count. If the drive determines that a failure is imminent, it generates a fault alert.

Hard Drive Capacities

The combination of the file system and the operating system used in the computer determines the maximum usable size of a drive partition. A drive partition is the largest segment of a drive that may be properly accessed by the operating system. A single hard drive may therefore be subdivided into a number of unique drive partitions in order to make use of all of its space.

Because of the differences in the way that drive sizes are calculated, the size reported by the operating system may differ from that marked on the hard drive or listed in the computer specification. Drive size calculations by drive manufacturers are bytes to the base 10 while calculations by Microsoft are bytes to the base 2.

Drive/Partition Capacity Limits

			Maximum Size	
File System	**Controller Type**	**Operating System**	**Partition**	**Drive**
FAT 32	ATA	Windows 2000/XP/Vista	32 GB	2 TB
NTFS	ATA	Windows 2000/XP/Vista	2 TB	2 TB

6 Identifying the Chassis, Routine Care, and Disassembly Preparation

This chapter provides general service information for the computer. Adherence to the procedures and precautions described in this chapter is essential for proper service.

△ **CAUTION:** When the computer is plugged into an AC power source, voltage is always applied to the system board. You must disconnect the power cord from the power source before opening the computer to prevent system board or component damage.

Chassis Designations

The following subsection illustrates the dx2810 chassis design.

Microtower (MT)

Figure 6-1 Model dx2810

Figure 6-2 Model dx2810 Special Edition

Figure 6-3 Model dx2818

Small Form Factor (SFF)

Figure 6-4 Model dx2810

Electrostatic Discharge Information

A sudden discharge of static electricity from your finger or other conductor can destroy static-sensitive devices or microcircuitry. Often the spark is neither felt nor heard, but damage occurs. An electronic device exposed to electrostatic discharge (ESD) may not appear to be affected at all and can work perfectly throughout a normal cycle. The device may function normally for a while, but it has been degraded in the internal layers, reducing its life expectancy.

Networks built into many integrated circuits provide some protection, but in many cases, the discharge contains enough power to alter device parameters or melt silicon junctions.

Generating Static

The following table shows that:

- Different activities generate different amounts of static electricity.
- Static electricity increases as humidity decreases.

	Relative Humidity		
Event	**55%**	**40%**	**10%**
Walking across carpet	7,500 V	15,000 V	35,000 V
Walking across vinyl floor	3,000 V	5,000 V	12,000 V
Motions of bench worker	400 V	800 V	6,000 V
Removing DIPs* from plastic tube	400 V	700 V	2,000 V

Removing DIPs* from vinyl tray	2,000 V	4,000 V	11,500 V
Removing DIPs* from Styrofoam	3,500 V	5,000 V	14,500 V
Removing bubble pack from PCB	7,000 V	20,000 V	26,500 V
Packing PCBs in foam-lined box	5,000 V	11,000 V	21,000 V
*These are then multi-packaged inside plastic tubes, trays, or Styrofoam.			

NOTE: 700 volts can degrade a product.

Preventing Electrostatic Damage to Equipment

Many electronic components are sensitive to ESD. Circuitry design and structure determine the degree of sensitivity. The following packaging and grounding precautions are necessary to prevent damage to electric components and accessories.

- To avoid hand contact, transport products in static-safe containers such as tubes, bags, or boxes.
- Protect all electrostatic parts and assemblies with conductive or approved containers or packaging.
- Keep electrostatic sensitive parts in their containers until they arrive at static-free stations.
- Place items on a grounded surface before removing them from their container.
- Always be properly grounded when touching a sensitive component or assembly.
- Avoid contact with pins, leads, or circuitry.
- Place reusable electrostatic-sensitive parts from assemblies in protective packaging or conductive foam.

Personal Grounding Methods and Equipment

Use the following equipment to prevent static electricity damage to equipment:

- **Wrist straps** are flexible straps with a maximum of one-megohm ± 10% resistance in the ground cords. To provide proper ground, a strap must be worn snug against bare skin. The ground cord must be connected and fit snugly into the banana plug connector on the grounding mat or workstation.
- **Heel straps/Toe straps/Boot straps** can be used at standing workstations and are compatible with most types of shoes or boots. On conductive floors or dissipative floor mats, use them on both feet with a maximum of one-megohm ± 10% resistance between the operator and ground.

Static Shielding Protection Levels	
Method	**Voltage**
Antistatic plastic	1,500
Carbon-loaded plastic	7,500
Metallized laminate	15,000

Grounding the Work Area

To prevent static damage at the work area, use the following precautions:

- Cover the work surface with approved static-dissipative material. Provide a wrist strap connected to the work surface and properly grounded tools and equipment.
- Use static-dissipative mats, foot straps, or air ionizers to give added protection.
- Handle electrostatic sensitive components, parts, and assemblies by the case or PCB laminate. Handle them only at static-free work areas.
- Turn off power and input signals before inserting and removing connectors or test equipment.
- Use fixtures made of static-safe materials when fixtures must directly contact dissipative surfaces.
- Keep work area free of nonconductive materials such as ordinary plastic assembly aids and Styrofoam.
- Use field service tools, such as cutters, screwdrivers, and vacuums, that are conductive.

Recommended Materials and Equipment

Materials and equipment that are recommended for use in preventing static electricity include:

- Antistatic tape
- Antistatic smocks, aprons, or sleeve protectors
- Conductive bins and other assembly or soldering aids
- Conductive foam
- Conductive tabletop workstations with ground cord of one-megohm +/- 10% resistance
- Static-dissipative table or floor mats with hard tie to ground
- Field service kits
- Static awareness labels
- Wrist straps and footwear straps providing one-megohm +/- 10% resistance
- Material handling packages
- Conductive plastic bags
- Conductive plastic tubes
- Conductive tote boxes
- Opaque shielding bags
- Transparent metallized shielding bags
- Transparent shielding tubes

Operating Guidelines

To prevent overheating and to help prolong the life of the computer:

- Keep the computer away from excessive moisture, direct sunlight, and extremes of heat and cold.
- Operate the computer on a sturdy, level surface. Leave a 10.2-cm (4-inch) clearance on all vented sides of the computer and above the monitor to permit the required airflow.
- Never restrict the airflow into the computer by blocking any vents or air intakes. Do not place the keyboard, with the keyboard feet down, directly against the front of the desktop unit as this also restricts airflow.
- Occasionally clean the air vents on all vented sides of the computer. Lint, dust, and other foreign matter can block the vents and limit the airflow. Be sure to unplug the computer before cleaning the air vents.
- Never operate the computer with the cover or side panel removed.
- Do not stack computers on top of each other or place computers so near each other that they are subject to each other's re-circulated or preheated air.
- If the computer is to be operated within a separate enclosure, intake and exhaust ventilation must be provided on the enclosure, and the same operating guidelines listed above will still apply.
- Keep liquids away from the computer and keyboard.
- Never cover the ventilation slots on the monitor with any type of material.
- Install or enable power management functions of the operating system or other software, including sleep states.

Routine Care

General Cleaning Safety Precautions

1. Never use solvents or flammable solutions to clean the computer.
2. Never immerse any parts in water or cleaning solutions; apply any liquids to a clean cloth and then use the cloth on the component.
3. Always unplug the computer when cleaning with liquids or damp cloths.
4. Always unplug the computer before cleaning the keyboard, mouse, or air vents.
5. Disconnect the keyboard before cleaning it.
6. Wear safety glasses equipped with side shields when cleaning the keyboard.

Cleaning the Computer Case

Follow all safety precautions in General Cleaning Safety Precautions on page 32 before cleaning the computer.

To clean the computer case, follow the procedures described below:

- To remove light stains or dirt, use plain water with a clean, lint-free cloth or swab.
- For stronger stains, use a mild dishwashing liquid diluted with water. Rinse well by wiping it with a cloth or swab dampened with clear water.
- For stubborn stains, use isopropyl (rubbing) alcohol. No rinsing is needed as the alcohol will evaporate quickly and not leave a residue.
- After cleaning, always wipe the unit with a clean, lint-free cloth.
- Occasionally clean the air vents on the computer. Lint and other foreign matter can block the vents and limit the airflow.

Cleaning the Keyboard

Follow all safety precautions in General Cleaning Safety Precautions on page 32 before cleaning the keyboard.

To clean the tops of the keys or the keyboard body, follow the procedures described in Cleaning the Computer Case on page 32.

When cleaning debris from under the keys, review all rules in General Cleaning Safety Precautions on page 32 before following these procedures:

△ **CAUTION:** Use safety glasses equipped with side shields before attempting to clean debris from under the keys.

- Visible debris underneath or between the keys may be removed by vacuuming or shaking.
- Canned, pressurized air may be used to clean debris from under the keys. Caution should be used as too much air pressure can dislodge lubricants applied under the wide keys.

- If you remove a key, use a specially designed key puller to prevent damage to the keys. This tool is available through many electronic supply outlets.

△ **CAUTION:** Never remove a wide leveled key (like the space bar) from the keyboard. If these keys are improperly removed or installed, the keyboard may not function properly.

- Cleaning under a key may be done with a swab moistened with isopropyl alcohol and squeezed out. Be careful not to wipe away lubricants necessary for proper key functions. Use tweezers to remove any fibers or dirt in confined areas. Allow the parts to air dry before reassembly.

Cleaning the Monitor

- Wipe the monitor screen with a clean cloth moistened with water or with a towelette designed for cleaning monitors. Do not use sprays or aerosols directly on the screen; the liquid may seep into the housing and damage a component. Never use solvents or flammable liquids on the monitor.
- To clean the monitor body follow the procedures in Cleaning the Computer Case on page 32.

Cleaning the Mouse

Before cleaning the mouse, ensure that the power to the computer is turned off.

- Clean the mouse ball by first removing the retaining plate and the ball from the housing. Pull out any debris from the ball socket and wipe the ball with a clean, dry cloth before reassembly.
- To clean the mouse body, follow the procedures in Cleaning the Computer Case on page 32.

Service Considerations

Listed below are some of the considerations that you should keep in mind during the disassembly and assembly of the computer.

Power Supply Fan

The power supply fan is a variable-speed fan based on the temperature in the power supply.

△ **CAUTION:** The cooling fan is always on when the computer is in the “On” mode. The cooling fan is off when the computer is in “Standby,” “Suspend,” or “Off” modes.

You must disconnect the power cord from the power source before opening the computer to prevent system board or component damage.

Tools and Software Requirements

To service the computer, you need the following:

- Torx T-15 screwdriver (HP screwdriver with bits, PN 161946-001)
- Torx T-15 screwdriver with small diameter shank (for certain front bezel removal)
- Flat-bladed screwdriver (may sometimes be used in place of the Torx screwdriver)
- Phillips #2 screwdriver

- Diagnostics software
- HP tamper-resistant T-15 wrench (Smart Cover FailSafe Key, PN 166527-001) or HP tamper-resistant bits (Smart Cover FailSafe Key, PN 166527-002)

Screws

The screws used in the computer are not interchangeable. They may have standard or metric threads and may be of different lengths. If an incorrect screw is used during the reassembly process, it can damage the unit. HP strongly recommends that all screws removed during disassembly be kept with the part that was removed, then returned to their proper locations.

△ **CAUTION:** Metric screws have a black finish. U.S. screws have a silver finish and are used on hard drives only.

CAUTION: As each subassembly is removed from the computer, it should be placed away from the work area to prevent damage.

Cables and Connectors

Most cables used throughout the unit are flat, flexible cables. These cables must be handled with care to avoid damage. Apply only the tension required to seat or unseat the cables during insertion or removal from the connector. Handle cables by the connector whenever possible. In all cases, avoid bending or twisting the cables, and ensure that the cables are routed in such a way that they cannot be caught or snagged by parts being removed or replaced.

△ **CAUTION:** When servicing this computer, ensure that cables are placed in their proper location during the reassembly process. Improper cable placement can damage the computer.

Hard Drives

Handle hard drives as delicate, precision components, avoiding all physical shock and vibration. This applies to failed drives as well as replacement spares.

- If a drive must be mailed, place the drive in a bubble-pack mailer or other suitable protective packaging and label the package “Fragile: Handle With Care.”
- Do not remove hard drives from the shipping package for storage. Keep hard drives in their protective packaging until they are actually mounted in the CPU.
- Avoid dropping drives from any height onto any surface.
- If you are inserting or removing a hard drive, turn off the computer. Do not remove a hard drive while the computer is on or in standby mode.
- Before handling a drive, ensure that you are discharged of static electricity. While handling a drive, avoid touching the connector. For more information about preventing electrostatic damage, refer to Electrostatic Discharge Information on page 28
- Do not use excessive force when inserting a drive.
- Avoid exposing a hard drive to liquids, temperature extremes, or products that have magnetic fields such as monitors or speakers.

Lithium Coin Cell Battery

The battery that comes with the computer provides power to the real-time clock and has a minimum lifetime of about three years.

See the appropriate removal and replacement chapter for the chassis you are working on in this guide for instructions on the replacement procedures.

⚠ **WARNING!** This computer contains a lithium battery. There is a risk of fire and chemical burn if the battery is handled improperly. Do not disassemble, crush, puncture, short external contacts, dispose in water or fire, or expose it to temperatures higher than 140ºF (60ºC). Do not attempt to recharge the battery.

NOTE: Batteries, battery packs, and accumulators should not be disposed of together with the general household waste. In order to forward them to recycling or proper disposal, please use the public collection system or return them to HP, their authorized partners, or their agents.

7 Removal and Replacement Procedures Microtower (MT) Chassis

Adherence to the procedures and precautions described in this chapter is essential for proper service. After completing all necessary removal and replacement procedures, run the Diagnostics utility to verify that all components operate properly.

NOTE: Not all features listed in this guide are available on all computers.

Serial Number Location

Each computer has a unique serial number and product ID number that are located on the top of the computer. Keep these numbers available for use when contacting customer service for assistance.

Figure 7-1 Serial Number and Product ID Location – dx2810

Figure 7-2 Serial Number and Product ID Location – dx2818

Preparation for Disassembly

1. Close any open software applications.
2. Exit the operating system.
3. Remove any diskette or compact disc from the computer.
4. Turn off the computer and any peripheral devices that are connected to it.

△ **CAUTION:** Turn off the computer before disconnecting any cables.

CAUTION: Regardless of the power-on state, voltage is always present on the system board as long as the system is plugged into an active AC outlet. In some systems the cooling fan is on even when the computer is in the “Standby,” or “Suspend” modes. The power cord should always be disconnected before servicing a unit.

5. Disconnect the power cord from the electrical outlet and then from the computer.
6. Disconnect all peripheral device cables from the computer.

NOTE: During disassembly, label each cable as you remove it, noting its position and routing. Keep all screws with the units removed.

△ **CAUTION:** The screws used in the computer are of different thread sizes and lengths; using the wrong screw in an application may damage the unit.

Access Panel

NOTE: The appearance of the power supply varies based on model.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Loosen the captive thumbscrew **(1)** that secures the access panel to the computer chassis.
3. Slide the access panel back **(2)** about 1.3 cm (1/2 inch), then lift it off the unit.

NOTE: You may want to lay the computer on its side to install internal parts. Be sure the side with the access panel is facing up.

Figure 7-3 Removing the Computer Access Panel

NOTE: If the access panel is removed while power is still supplied to the computer, the hood sensor will sound an alarm. If the alarm sounds, unplug the computer and leave it unplugged until the access panel is replaced.

To replace the access panel, reverse the removal steps.

Front Bezel

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Press outward on the three latches on the right side of the bezel **(1)**, then rotate the right side of the bezel off the chassis **(2)** followed by the left side.

Figure 7-4 Removing the Front Bezel – dx2810

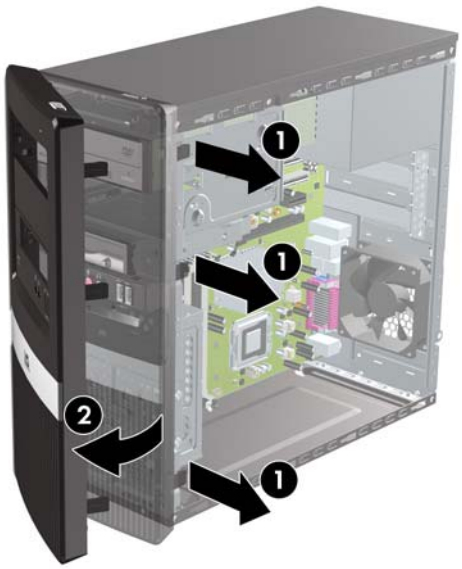
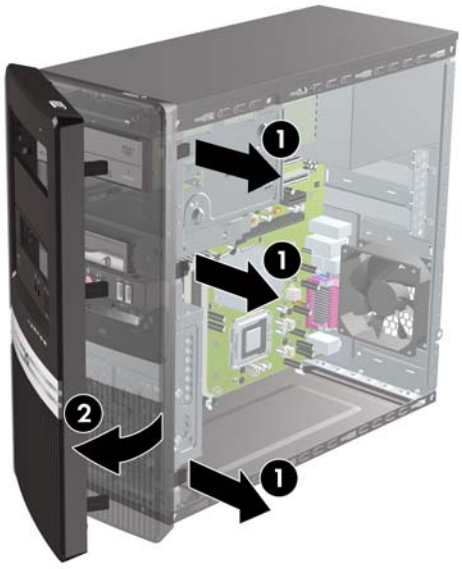


Figure 7-5 Removing the Front Bezel – dx2818



NOTE: The appearance of the front bezel may vary.

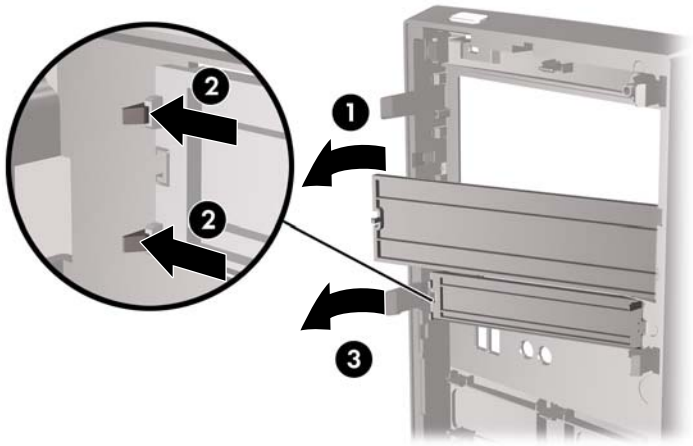
To reinstall the front bezel, reverse the removal procedure.

Bezel Blanks

On some models, there are bezel blanks covering the 3.5-inch and 5.25-inch external drive bays that need to be removed before installing a drive. To remove a bezel blank:

1. Remove the front bezel (Front Bezel on page 39).
2. To remove the lower 5.25-inch bezel blank, gently twist and pull on the bezel blank until it breaks free from the front bezel **(1)**, then discard the bezel blank. If the blank needs to be replaced at a later date, you can order a replacement blank from HP.
3. To remove the 3.5-inch bezel blank, press the two retaining tabs towards the outer left edge of the bezel **(2)** and pull the bezel blank inwards to free it from the front bezel **(3)**.

Figure 7-6 Removing a Bezel Blank



Memory

The computer comes with double data rate 2 synchronous dynamic random access memory (DDR2-SDRAM) dual inline memory modules (DIMMs).

△ **CAUTION:** DDR and DDR2 memory modules are not interchangeable.

DIMMs

The memory sockets on the system board can be populated with up to four industry-standard DIMMs. These memory sockets are populated with at least one preinstalled DIMM. To achieve the maximum memory support, you can populate the system board with up to 8 GB of memory configured in a high-performing dual channel mode.

DDR2-SDRAM DIMMs

For proper system operation, the DDR2-SDRAM DIMMs must be:

- industry-standard 240-pin
- unbuffered PC2-6400 800 MHz-compliant
- 1.8 volt DDR2-SDRAM DIMMs

The DDR2-SDRAM DIMMs must also:

- support CAS latency 5 DDR2 800 Mhz (5-5-5 timing) and CAS latency 6 DDR2 800 Mhz (6-6-6 timing)
- contain the mandatory JEDEC SPD information

In addition, the computer supports:

- 512Mbit, 1Gbit, and 2Gbit non-ECC memory technologies
- single-sided and double-sided DIMMs
- DIMMs constructed with x8 and x16 DDR devices; DIMMs constructed with x4 SDRAM are not supported

NOTE: The system will not operate properly if you install unsupported DIMMs.

Populating DIMM Sockets

There are four DIMM sockets on the system board, with two sockets per channel. The sockets are labeled XMM1, XMM2, XMM3, and XMM4. Sockets XMM1 and XMM2 operate in memory channel A. Sockets XMM3 and XMM4 operate in memory channel B.

Figure 7-7 DIMM Socket Locations

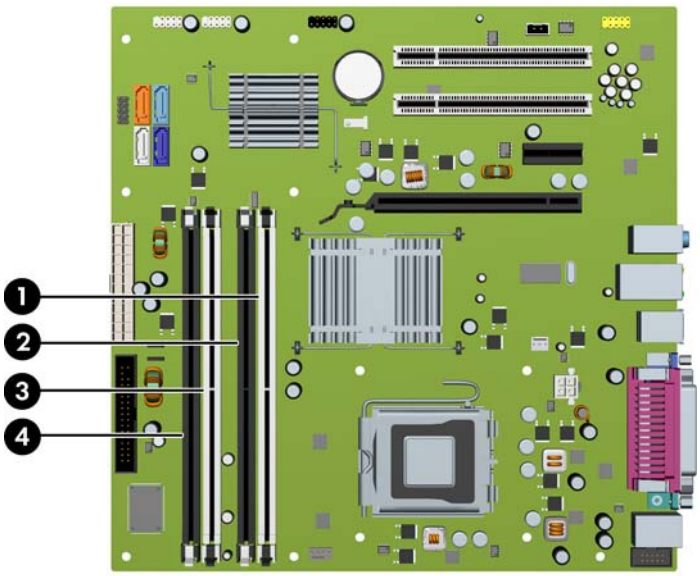


Table 7-1 DIMM Socket Locations

Item	Description	Socket Color
1	XMM1 socket, Channel A (populate first)	White
2	XMM2 socket, Channel A	Black
3	XMM3 socket, Channel B (populate second)	White
4	XMM4 socket, Channel B	Black
NOTE: A DIMM must occupy the XMM1 socket.		

The system will automatically operate in single channel mode, dual channel mode, or flex mode, depending on how the DIMMs are installed.

- The system will operate in single channel mode if the DIMM sockets are populated in one channel only.
- The system will operate in a higher-performing dual channel mode if the total memory capacity of the DIMMs in Channel A is equal to the total memory capacity of the DIMMs in Channel B. The technology and device width can vary between the channels. For example, if Channel A is populated with two 512-MB DIMMs and Channel B is populated with one 1-GB DIMM, the system will operate in dual channel mode.
- The system will operate in flex mode if the total memory capacity of the DIMMs in Channel A is not equal to the total memory capacity of the DIMMs in Channel B. In flex mode, the channel populated with the least amount of memory describes the total amount of memory assigned to dual channel

and the remainder is assigned to single channel. For optimal speed, the channels should be balanced so that the largest amount of memory is spread between the two channels. If one channel will have more memory than the other, the larger amount should be assigned to Channel A. For example, if you are populating the sockets with one 1-GB DIMM, and three 512-MB DIMMs, Channel A should be populated with the 1-GB DIMM and one 512-MB DIMM, and Channel B should be populated with the two 512-MB DIMMs. With this configuration, 2-GB will run as dual channel and 512-MB will run as single channel.

- In any mode, the maximum operational speed is determined by the slowest DIMM in the system.

Installing DIMMs

△ **CAUTION:** You must disconnect the power cord and wait approximately 30 seconds for the power to drain before adding or removing memory modules. Regardless of the power-on state, voltage is always supplied to the memory modules as long as the computer is plugged into an active AC outlet. Adding or removing memory modules while voltage is present may cause irreparable damage to the memory modules or system board.

The memory module sockets have gold-plated metal contacts. When upgrading the memory, it is important to use memory modules with gold-plated metal contacts to prevent corrosion and/or oxidation resulting from having incompatible metals in contact with each other.

Static electricity can damage the electronic components of the computer or optional cards. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

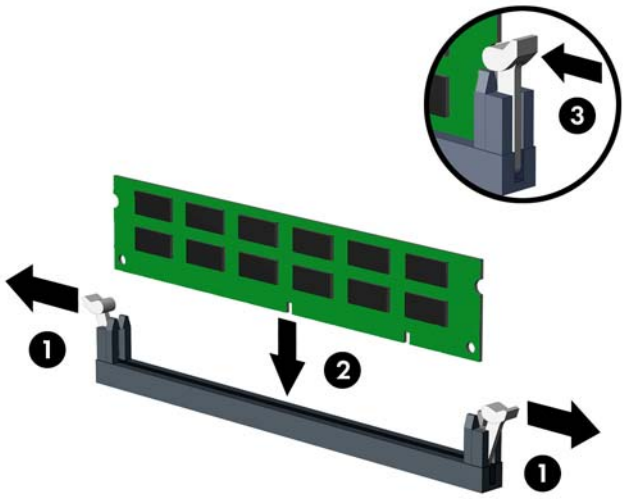
When handling a memory module, be careful not to touch any of the contacts. Doing so may damage the module.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Locate the memory module sockets on the system board.

⚠ **WARNING!** To reduce risk of personal injury from hot surfaces, allow the internal system components to cool before touching.

4. Open both latches of the memory module socket **(1)**, and insert the memory module into the socket **(2)**.

Figure 7-8 Installing a DIMM



NOTE: A memory module can be installed in only one way. Match the notch on the module with the tab on the memory socket.

A DIMM must occupy the XMM1 socket. Always populate the white sockets before the black sockets in each channel.

In order to create a dual-channel memory configuration, the memory capacity of Channel A must equal the memory capacity of Channel B. Refer to Populating DIMM Sockets on page 42 for more information.

5. Push the DIMM module down firmly into the socket, ensuring that the module is fully inserted and properly seated. The DIMM must be pushed all the way down into the socket and sit evenly in the socket to avoid memory corruption. Make sure the latches are in the closed position **(3)**.
6. Repeat steps 5 and 6 to install any additional modules.
7. Replace the computer access panel.
8. Reconnect the power cord and any external devices, then turn on the computer. The computer should automatically recognize the additional memory when you turn on the computer.
9. Lock any security devices that were disengaged when the access panel was removed.

Expansion Cards

The computer has two standard PCI expansion slots, one PCI Express x1 expansion slot, and one PCI Express x16 expansion slot. The expansion slots accommodate full-height or half-height expansion cards.

Figure 7-9 Expansion Slot Locations

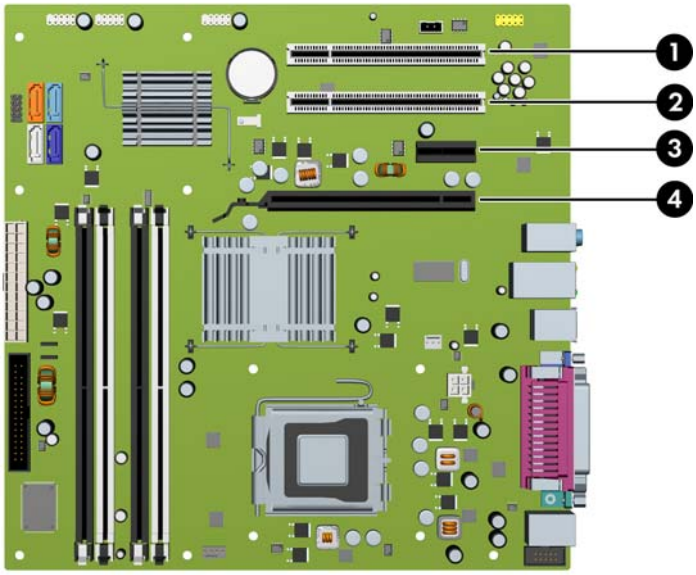


Table 7-2 Expansion Slot Locations

Item	Description
1	PCI expansion slot
2	PCI expansion slot
3	PCI Express x1 expansion slot
4	PCI Express x16 expansion slot

NOTE: You can install a PCI Express x1, x4, x8, or x16 expansion card in the PCI Express x16 expansion slot.

To remove, replace, or add an expansion card:

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Locate the correct vacant expansion socket on the system board and the corresponding expansion slot on the back of the computer chassis.

4. On the rear of the computer, a slot cover lock secures the expansion card brackets in place. Remove the screw from the slot cover lock then slide the slot cover lock up to remove it from the chassis.

Figure 7-10 Opening the Slot Cover Lock

5. Before installing an expansion card, remove the expansion slot cover or the existing expansion card.

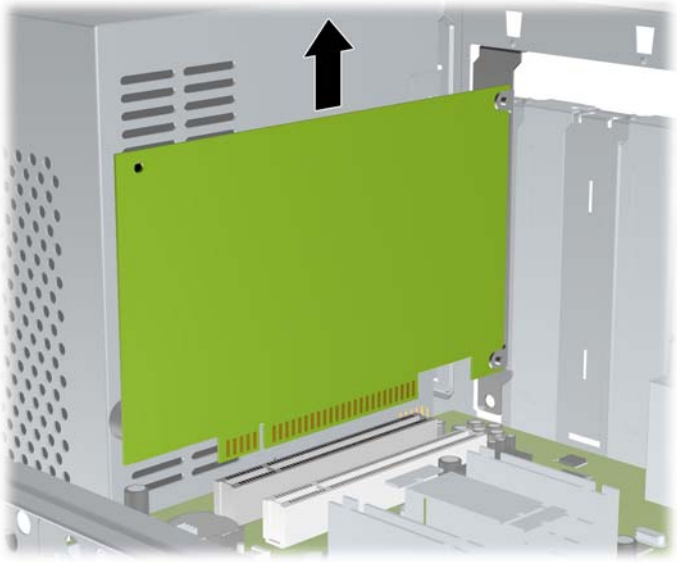
NOTE: Before removing an installed expansion card, disconnect any cables that may be attached to the expansion card.

a. If you are installing an expansion card in a vacant socket, you must use a flatblade screwdriver to pry out the metal shield on the rear panel that covers the expansion slot. Be sure to remove the appropriate shield for the expansion card you are installing.

Figure 7-11 Removing an Expansion Slot Cover

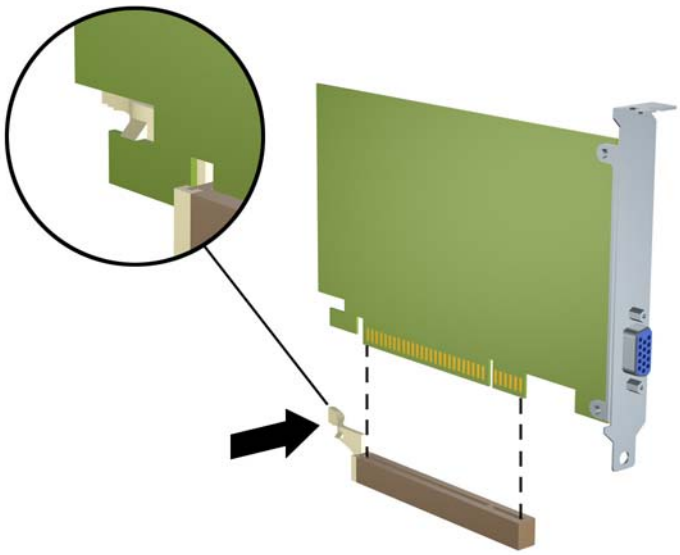
b. If you are removing a PCI or PCI Express x1 card, hold the card at each end and carefully rock it back and forth until the connectors pull free from the socket. Be sure not to scrape the card against the other components.

Figure 7-12 Removing a PCI or PCI Express x1 Expansion Card



c. If you are removing a PCI Express x16 card, pull the retention arm on the back of the expansion socket away from the card and carefully rock the card back and forth until the connectors pull free from the socket. Be sure not to scrape the card against the other components.

Figure 7-13 Removing a PCI Express x16 Expansion Card

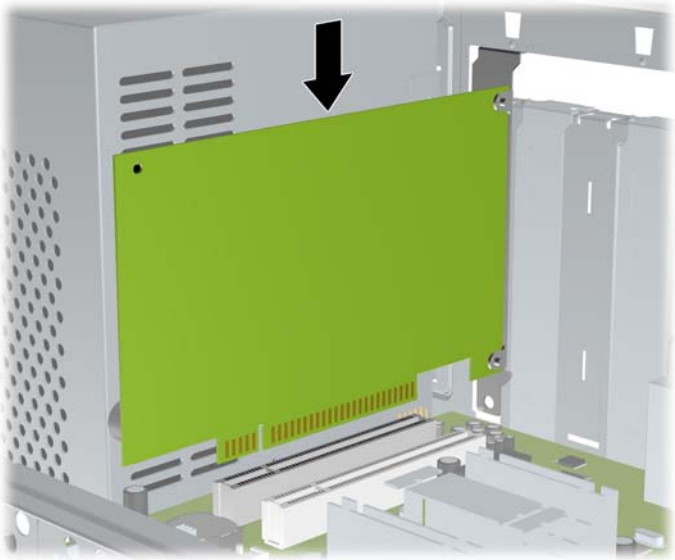


6. Store the removed card in anti-static packaging.
7. If you are not installing a new expansion card, install an expansion slot cover to close the open slot.

△ **CAUTION:** After removing an expansion card, you must replace it with a new card or expansion slot cover for proper cooling of internal components during operation.

8. To install a new expansion card, hold the card just above the expansion socket on the system board then move the card toward the rear of the chassis so that the bottom of the bracket on the card slides into the small slot on the chassis. Press the card straight down into the expansion socket on the system board.

Figure 7-14 Installing an Expansion Card



NOTE: When installing an expansion card, press firmly on the card so that the whole connector seats properly in the expansion card slot.

9. Replace the slot cover lock and secure it in place with the screw that was previously removed.

Figure 7-15 Securing the Expansion Cards and Slot Covers

NOTE: The appearance of the power supply varies based on model.

10. Connect external cables to the installed card, if needed. Connect internal cables to the system board, if needed.

11. Replace the computer access panel.
12. Reconnect the power cord and any external devices, then turn on the computer.
13. Lock any security devices that were disengaged when the access panel was removed.
14. Reconfigure the computer, if necessary. Refer to the *Computer Setup (F10) Utility Guide* for instructions on using Computer Setup.

Cable Management

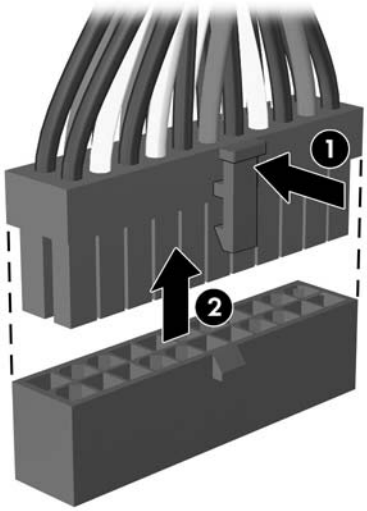
Always follow good cable management practices when working inside the computer.

- Keep cables away from major heat sources like the heatsink.
- Do not jam cables on top of expansion cards or memory modules. Printed circuit cards like these are not designed to take excessive pressure on them.
- Some flat ribbon cables come pre-folded. Never change the folds on these cables.
- Never bend a SATA data cable tighter than a 30 mm (1.18 in) radius.
- Never crease a SATA data cable.
- Do not rely on components like the drive cage, power supply, or computer cover to push cables down into the chassis. Always position the cables to lay properly by themselves.

When removing the power supply power cable from the P1 connector on the system board, always follow these steps:

1. Squeeze on the top of the retaining latch attached to the cable end of the connector **(1)**.
2. Grasp the cable end of the connector and pull it straight up **(2)**.

△ **CAUTION:** Always pull the connector - NEVER pull on the cable. Pulling on the cable could damage the cable and result in a failed power supply.



Cable Connections

System board connectors are color-coded to make it easier to find the proper connection.

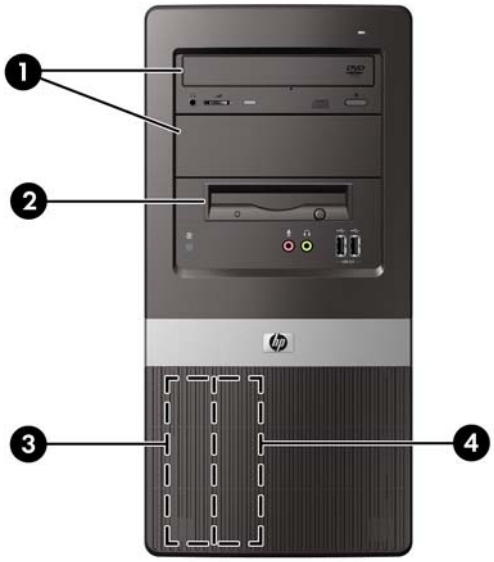
Connector Name	Connector Color	Description
ATXPOWER	White	Power supply, 24-pin
ATX_CPU	White	Power supply, 4-pin
FLOPPY	Black	Diskette drive
CHASSIS_FAN1	Brown	Chassis fan
CPU FAN	White	Heatsink fan
F_PANEL	Black	Front power button/LED
F_USB1	White	Front I/O USB cable
F_AUDIO	Yellow	Front I/O audio
SPEAKER	White	Internal speaker
F_1394	Red	Serial port
F_USB2	Black	Media card reader
SATA0	dark blue	Primary hard drive
SATA1	white	Primary optical drive
SATA4	red	Second hard drive
SATA5	black	Second optical drive

Drives

Drive Positions

NOTE: The appearance of the front bezel may vary.

Figure 7-16 Drive Positions



1	Two 5.25-inch external drive bays for optional drives (optical drive shown)
2	One 3.5-inch external drive bay for optional drive (diskette drive shown)
3	Primary 3.5-inch internal hard drive bay
4	Secondary 3.5-inch internal hard drive bay for optional hard drive

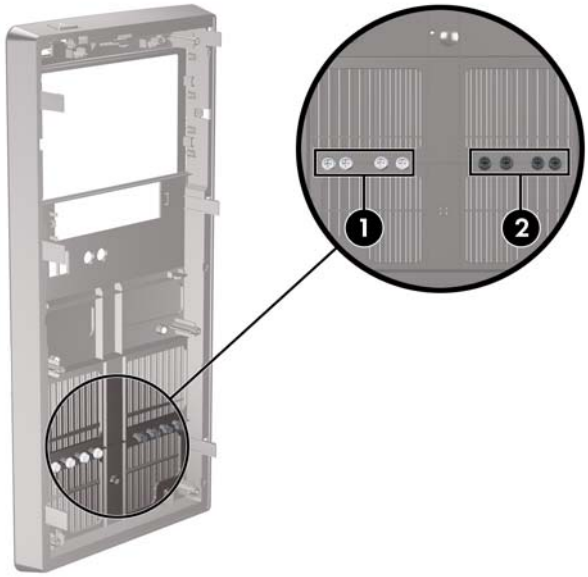
To verify the type, size, and capacity of the storage devices installed in the computer, run Computer Setup. Refer to the *Computer Setup (F10) Utility Guide* for more information.

Installing Additional Drives

When installing additional drives, follow these guidelines:

- The primary Serial ATA (SATA) hard drive must be connected to the dark blue primary SATA connector on the system board labeled SATA1.
- Connect the first SATA optical drive to the white SATA connector on the system board labeled SATA2.
- Connect a second SATA optical drive to the orange SATA4 connector.
- Connect a second SATA hard drive to the light blue SATA3 connector.
- Connect a diskette drive to the connector labeled FLOPPY.
- Connect a media card reader to the USB connector labeled F_USB2.
- The system does not support Parallel ATA (PATA) optical drives or PATA hard drives.
- You may install either a third-height or a half-height drive into a half-height bay.
- If needed, HP has provided extra drive retainer screws on the interior of the front bezel that are used to secure the drives in the drive cage. Hard drives use 6-32 standard screws. All other drives use M3 metric screws. The HP-supplied 6-32 standard screws **(1)** are silver. The HP-supplied M3 metric guide screws **(2)** are black.

Figure 7-17 Extra Drive Retainer Screws Location



△ **CAUTION:** To prevent loss of work and damage to the computer or drive:

If you are inserting or removing a drive, shut down the operating system properly, turn off the computer, and unplug the power cord. Do not remove a drive while the computer is on or in standby mode.

Before handling a drive, ensure that you are discharged of static electricity. While handling a drive, avoid touching the connector.

Handle a drive carefully; do not drop it.

Do not use excessive force when inserting a drive.

Avoid exposing a hard drive to liquids, temperature extremes, or products that have magnetic fields such as monitors or speakers.

If a drive must be mailed, place the drive in a bubble-pack mailer or other protective packaging and label the package “Fragile: Handle With Care.”

System Board Drive Connections

Refer to the following illustration and table to identify the system board drive connectors.

Figure 7-18 System Board Drive Connections

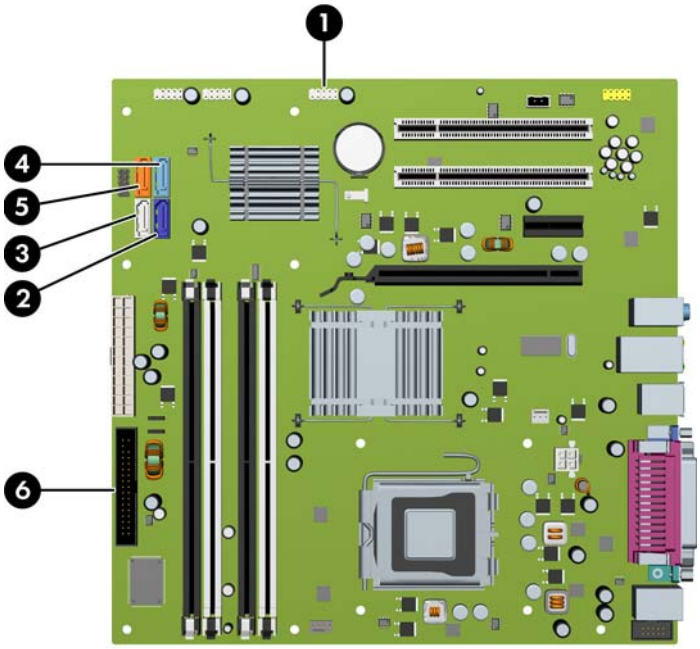


Table 7-3 System Board Drive Connections

No.	System Board Connector	System Board Label	Color
1	Media Card Reader	F_USB2	white
2	SATA1	SATA1	dark blue
3	SATA2	SATA2	white
4	SATA3	SATA3	light blue
5	SATA4	SATA4	orange
6	Diskette Drive	FLOPPY	black

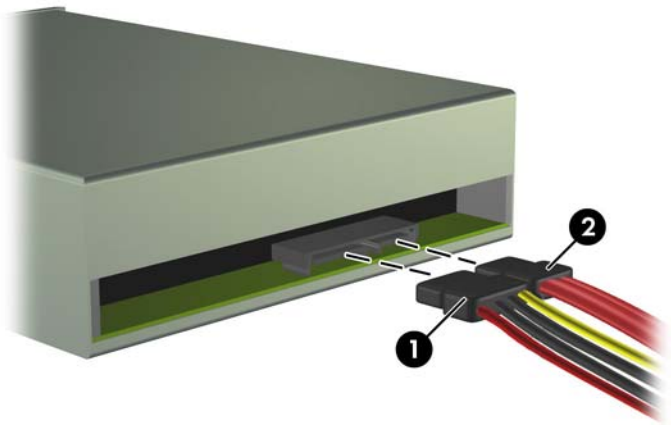
Removing an Optical Drive

△ **CAUTION:** All removable media should be taken out of a drive before removing the drive from the computer.

To remove an optical drive:

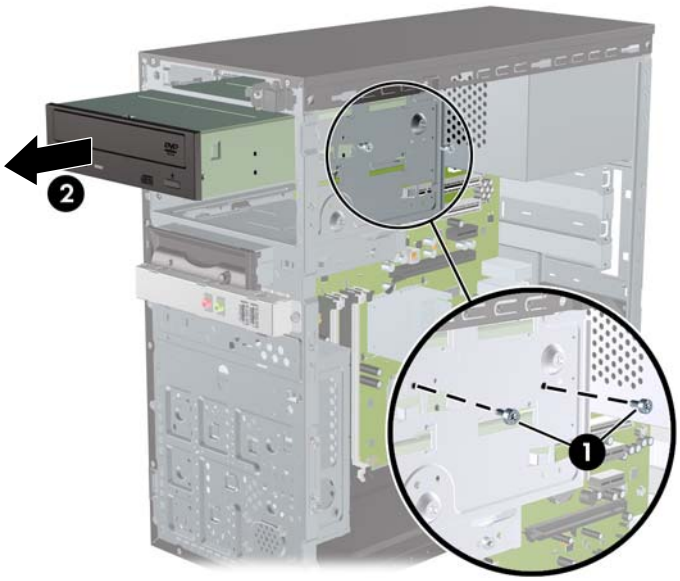
1. Disconnect the power cable **(1)** and data cable **(2)** from the rear of the optical drive.

   Figure 7-19 Disconnecting the Power and Data Cables



2. Remove the two screws that secure the drive to the drive cage **(1)**, then slide the drive out of the front of the chassis **(2)**.

   Figure 7-20 Removing the Optical Drive



NOTE: To install an optical drive, refer to Installing an Optical Drive into the 5.25-inch Drive Bay on page 56.

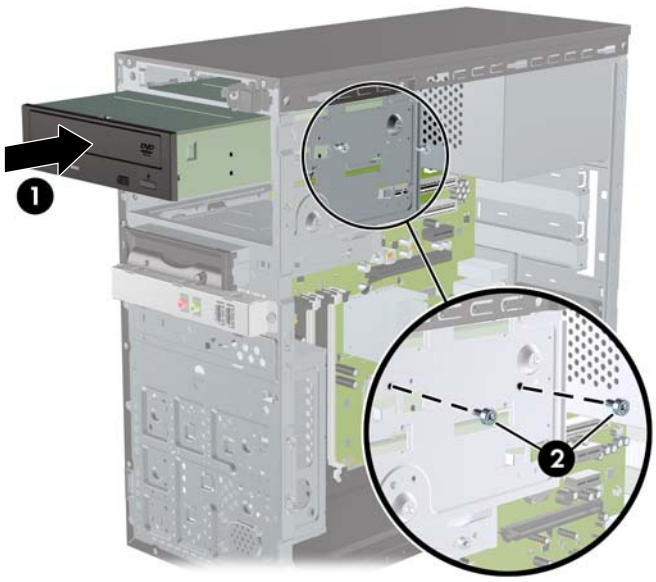
Installing an Optical Drive into the 5.25-inch Drive Bay

To install an optional 5.25-inch optical drive:

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Remove the front bezel (Front Bezel on page 39).
4. If you are installing a drive in a bay covered by a bezel blank, remove the front bezel then remove the bezel blank. See Bezel Blanks on page 40 for more information.
5. If you are adding a drive to an empty lower optical drive bay, you must remove the knockout plate from the bay. To do so, insert a flat screwdriver into the knockout plate slot and rotate the screwdriver to break the knockout plate out of the chassis. Discard the knockout plate.
6. If the new drive has screws installed on the sides of the drive, remove the screws before inserting the drive into the chassis.
7. Slide the drive in through the front of the chassis **(1)** until the screw holes on the drive are aligned with the screw holes on the drive cage and install the two M3 metric retainer screws **(2)** as shown in the following illustration.

NOTE: Extra drive retainer screws are provided on the interior of the front bezel if needed. The M3 metric retainer screws for optical drives are black.

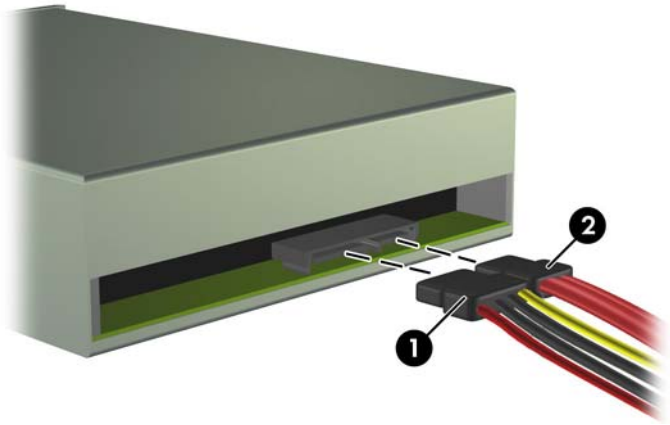
Figure 7-21 Installing the Optical Drive



8. If the system configuration includes only one optical drive, connect the SATA data cable to the white system board connector labeled SATA2. If you are adding a second optical drive, connect the SATA data cable to the orange system board connector labeled SATA4.

9. Connect the power cable **(1)** and data cable **(2)** to the rear of the optical drive.

Figure 7-22 Connecting the Power and Data Cables



10. Replace the front bezel and access panel.
11. Reconnect the power cord and turn on the computer.
12. Lock any security devices that were disengaged when the access panel was removed.

The system automatically recognizes the drive and reconfigures the computer.

Removing an External 3.5-inch Drive

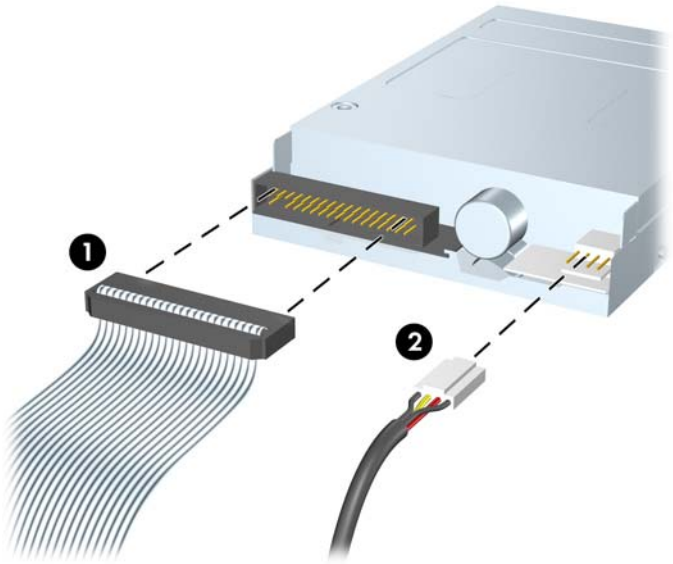
△ **CAUTION:** All removable media should be taken out of a drive before removing the drive from the computer.

NOTE: The 3.5-inch drive bay may contain a diskette drive or a media card reader.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Remove the front bezel (Front Bezel on page 39).

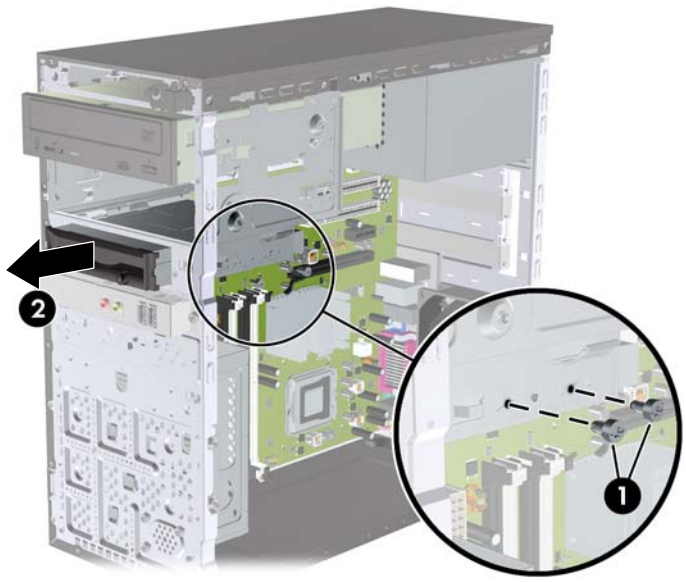
4. Disconnect the data cable **(1)** and power cable **(2)** from the rear of the drive.

Figure 7-23 Disconnecting the Diskette Drive Cables



5. Remove the two retainer screws that secure the drive to the bay **(1)** then slide the drive forward and out of the bay **(2)**.

Figure 7-24 Removing a 3.5-inch Device (Diskette Drive Shown)



NOTE: To install an external 3.5-inch drive, refer to Installing a Drive into the 3.5-inch External Drive Bay on page 59.

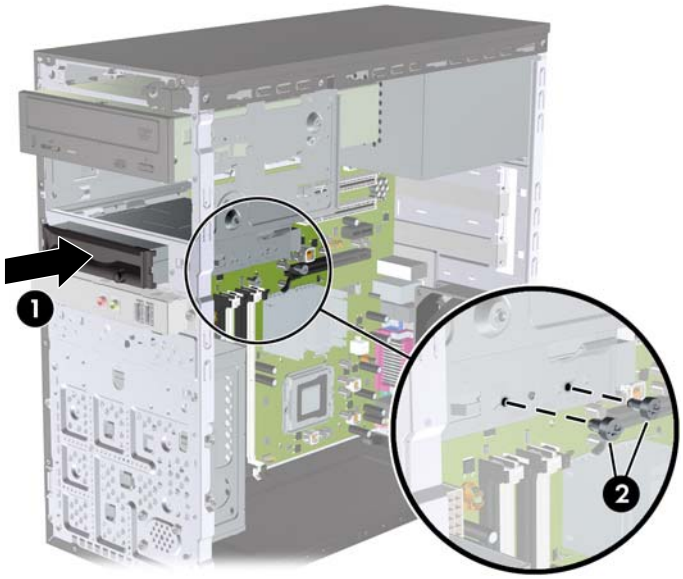
Installing a Drive into the 3.5-inch External Drive Bay

The 3.5-inch external drive bay on the front of the computer can be configured with a media card reader or a diskette drive.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Remove the front bezel (Front Bezel on page 39).
4. If you are installing a drive in a bay covered by a bezel blank, remove the front bezel then remove the bezel blank. See Bezel Blanks on page 40 for more information.
5. If you are adding a drive to an empty drive bay for the first time, you must remove the knockout plate from the bay. To do so, insert a flat screwdriver into the knockout plate slot and rotate the screwdriver to break the knockout plate out of the chassis. Discard the knockout plate.
6. If the new drive has screws installed on the sides of the drive, remove them before inserting the drive into the chassis.
7. Slide the drive in through the front of the chassis **(1)** until the screw holes on the drive are aligned with the screw holes on the drive cage and install the two M3 metric retainer screws **(2)** as shown in the illustration below.

NOTE: Extra drive retainer screws are provided on the interior of the front bezel if needed. The M3 metric retainer screws for diskette drives or media card readers are black. Refer to Installing Additional Drives on page 52 for an illustration of the retainer screws location.

Figure 7-25 Installing a 3.5-inch Device (Diskette Drive Shown)



8. Connect the appropriate drive cables:
   a. If installing a diskette drive, connect the power and data cables to the rear of the drive and connect the other end of the data cable to the connector on the system board labeled FLOPPY.
   b. If installing a media card reader, connect the USB cable from the media card reader to the USB connector on the system board labeled F_USB2.

NOTE: Refer to System Board Drive Connections on page 54 for an illustration of the system board drive connectors.

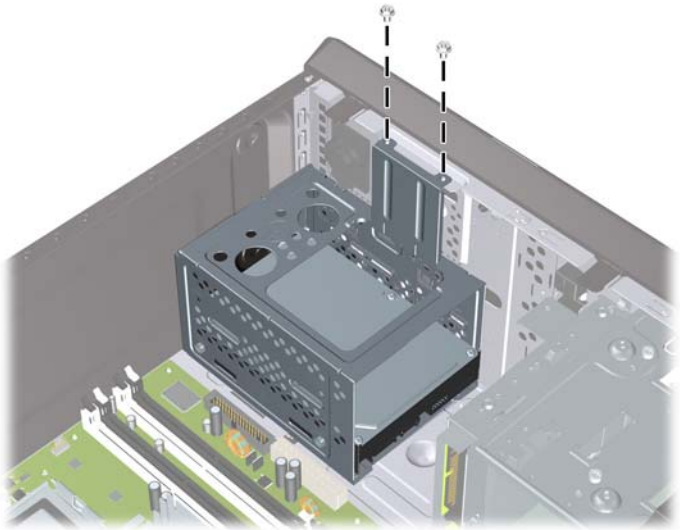
9. Replace the front bezel and access panel.
10. Reconnect the power cord and turn on the computer.
11. Lock any security devices that were disengaged when the access panel was removed.

Removing an Internal 3.5-inch Hard Drive

NOTE: Before you remove the old hard drive, be sure to back up the data from the old hard drive so that you can transfer the data to the new hard drive. Also, if you are replacing the primary hard drive, make sure you have created a Recovery Disc Set to restore the operating system, software drivers, and any software applications that were preinstalled on the computer. If you do not have this CD set, select **Start** > **HP Backup and Recovery** and create it now.

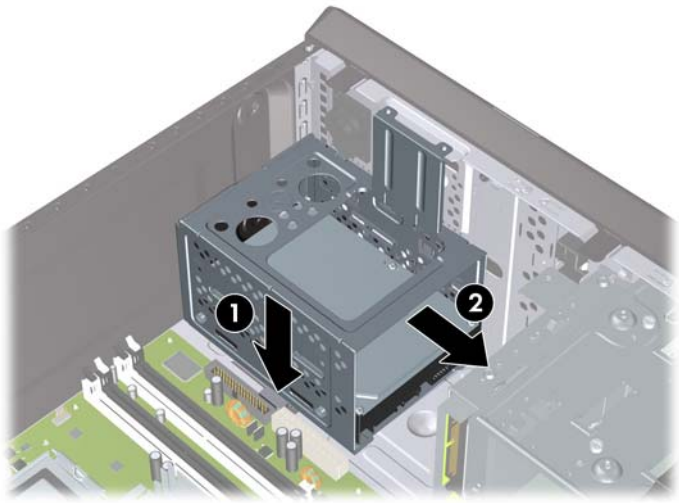
1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Remove the two screws that secure the hard drive cage to the chassis.

Figure 7-26 Removing the Hard Drive Cage Screws



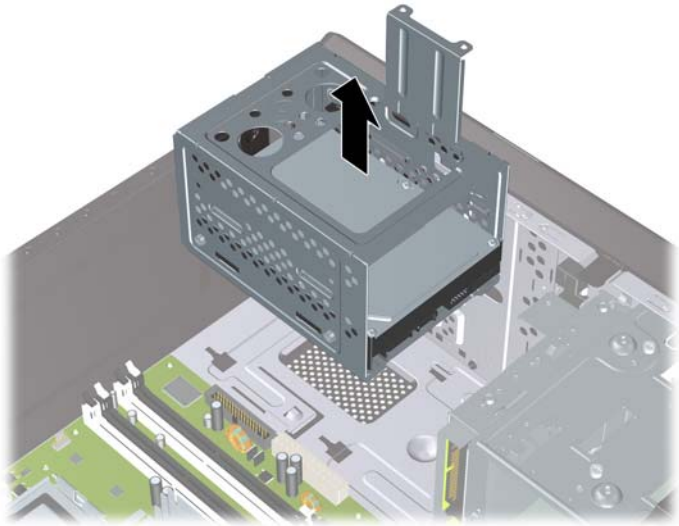
4. Push down the latch on the side of the hard drive cage **(1)**, then slide the hard drive cage away from the bottom of the chassis **(2)** as shown below.

Figure 7-27 Releasing the Hard Drive Cage



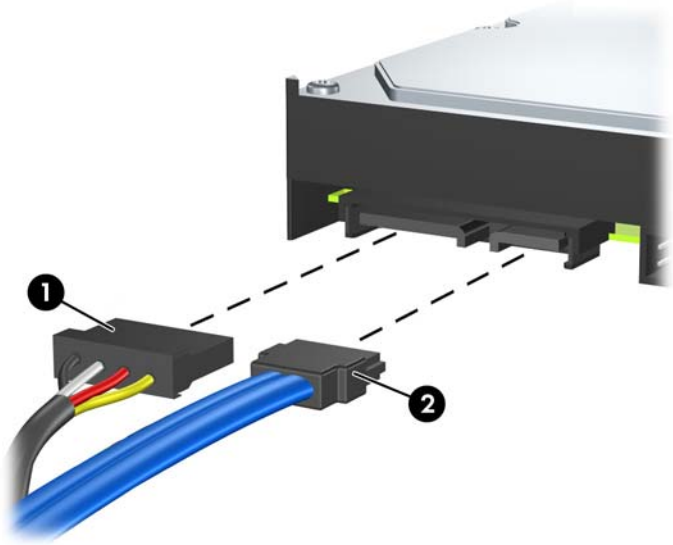
5. Lift the hard drive cage out of the chassis.

Figure 7-28 Removing the Hard Drive Cage



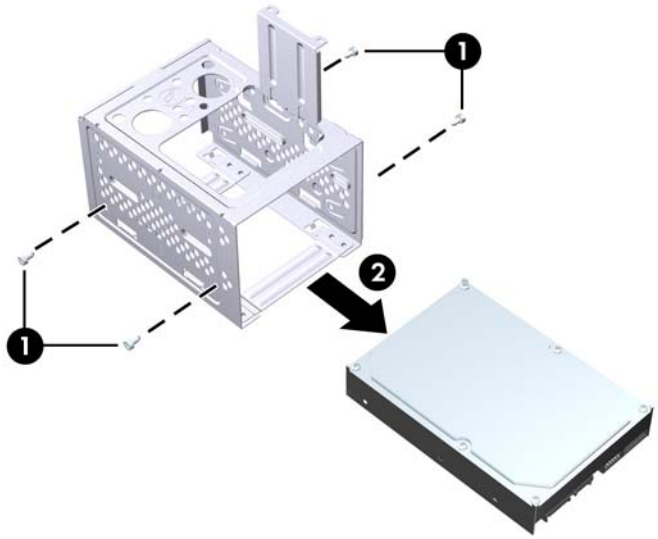
6. Disconnect the power cable **(1)** and data cable **(2)** from the back of the hard drive.

Figure 7-29 Disconnecting the Hard Drive Cables



7. Remove the four screws that secure the hard disk drive to the hard drive cage (1), then slide the hard disk drive out of the hard drive cage **(2)**.

Figure 7-30 Removing the Hard Drive



NOTE: To install an internal 3.5-inch hard drive, refer to Installing an Internal 3.5-inch Hard Drive on page 63.

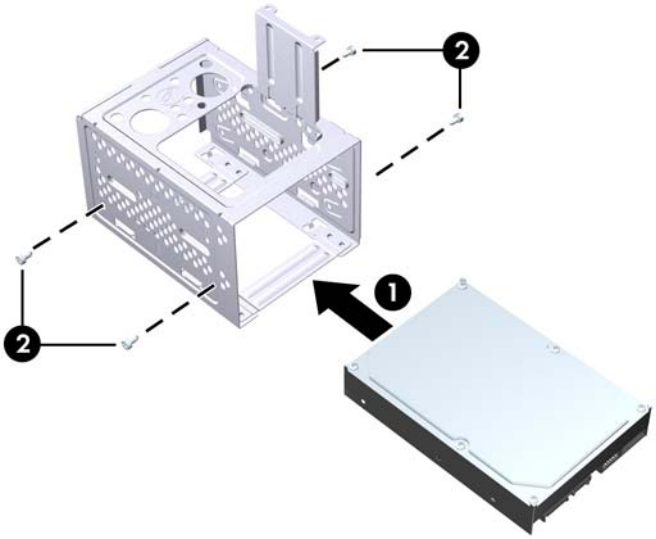
Installing an Internal 3.5-inch Hard Drive

1. Remove the hard drive cage and, if necessary, the existing hard drive.
2. Slide the new drive into the hard drive cage **(1)**, aligning the drive with the four screw holes on the cage. Install the four 6-32 standard screws that secure the hard disk drive to the hard drive cage **(2)**. Make sure the hard disk drive cables are facing the top of the drive cage.

NOTE: If you are replacing an old drive with a new drive, use the four retainer screws from the old drive to install the new drive.

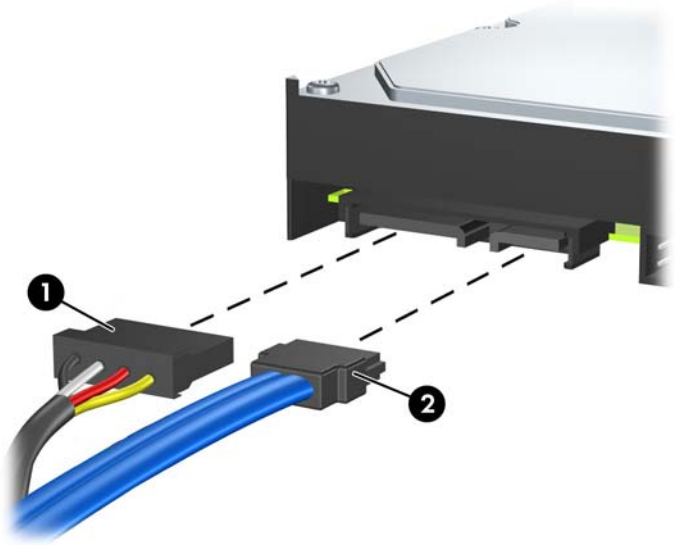
NOTE: If you are installing a second hard drive, use four of the extra standard 6-32 screws that are installed on the interior of the front bezel. The 6-32 screws are silver.

Figure 7-31 Installing the Hard Drive in the Drive Cage



3. Connect the power cable **(1)** and data cable **(2)** to the back of the hard drive.

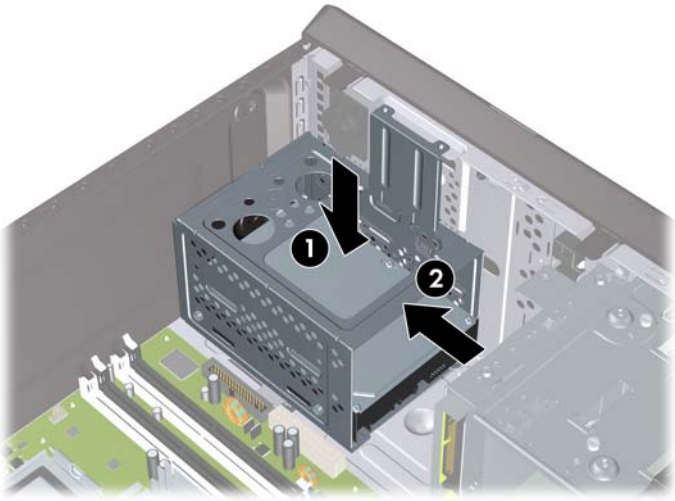
Figure 7-32 Connecting the Hard Drive Cables



△ **CAUTION:** Never crease or bend a SATA data cable tighter than a 30 mm (1.18 in) radius. A sharp bend can break the internal wires.

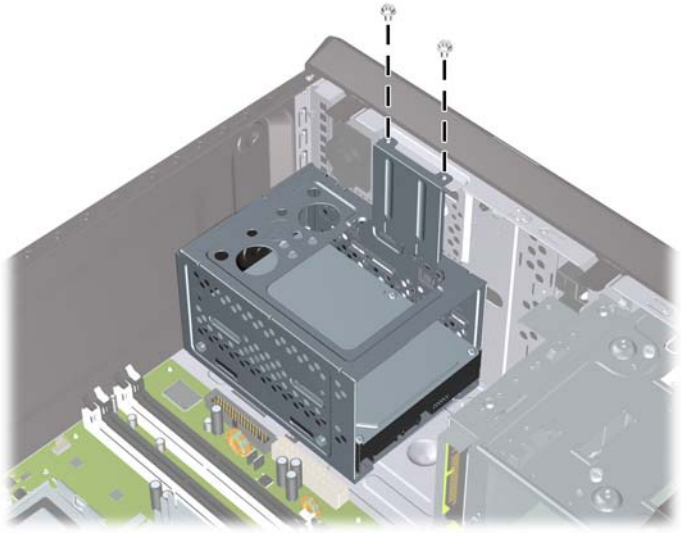
4. Place the hard drive cage into the chassis **(1)**, then slide it down toward the bottom of the chassis until it locks into place **(2)**.

Figure 7-33 Installing the Hard Drive Cage



5. Attach the two screws that secure the hard drive cage to the chassis.

Figure 7-34 Securing the Hard Drive Cage



6. If installing a new drive, connect the opposite end of the data cable to the appropriate system board connector.

NOTE: If your system has only one SATA hard drive, you must connect the hard drive data cable to the dark blue connector labeled SATA1 to avoid any hard drive performance problems. If you are adding a second hard drive, connect the data cable to the light blue connector labeled SATA3.

7. Replace the computer access panel.
8. Reconnect the power cord and any external devices, then turn on the computer.
9. Lock any security devices that were disengaged when the access panel was removed.

NOTE: If you are replacing the primary hard drive, use the Recovery Disc Set to restore the operating system, software drivers, and any software applications that were preinstalled on the computer.

Front I/O and USB Panel Housing Assembly

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38)
3. Lay the computer on its side with the front facing toward you.
4. Remove the front bezel (Front Bezel on page 39).
5. Unplug the four cables that connect the assembly to the system board.
6. Remove the screw **(1)** that secures the housing to the chassis, slide the housing up **(2)**, and then pull the assembly away from the chassis while guiding the cables through the hole in the chassis.

To install the housing assembly, reverse the removal procedures.

Power Switch/LED Assembly

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Lay the computer on its side with the front facing toward you.
4. Remove the front bezel (Front Bezel on page 39).
5. Remove the optical drive (Removing an Optical Drive on page 55).
6. Disconnect the braided cables from the system board.
7. Remove the cable from the clips in the optical drive cage.
8. Press the tab on the right side of the switch holder **(1)** to disengage it from the chassis, rotate the switch to the left **(2)**, and then pull it to the right and away from the chassis while guiding the wires through the hole in the chassis.

To install the power switch/LED assembly, reverse the removal procedures.

System Fan

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Lay the computer on its side with the rear facing toward you.
4. Disconnect the cable that connects the system fan to the system board.
5. Remove the four Phillips screws that secure the fan to the chassis, rotate the top of the fan forward, and then remove the fan from the chassis.

NOTE: The appearance of the power supply varies based on model.

To install the fan, reverse the removal procedures.

Heatsink assembly

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Lay the computer on its side with the rear facing toward you.
4. Disconnect the heatsink fan control cable from the system board.
5. Loosen the four captive screws that secure the heatsink to the system board.
6. Lift the heatsink from the processor and set it on its side to keep from contaminating the work area with thermal grease.

△ **CAUTION:** Heatsink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heatsink to the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

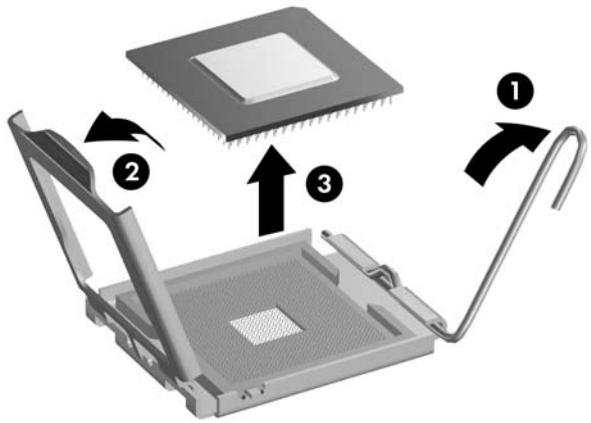
When reinstalling an existing heatsink, make sure that its bottom has been cleaned with an alcohol wipe and fresh thermal grease has been applied to the top of the processor. New heatsinks come from the factory with fresh thermal grease already applied.

Processor

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Lay the computer on its side with the rear facing toward you.
4. Disconnect the heatsink control cable from the system board and remove the heatsink Heatsink assembly on page 69).
5. Rotate the locking lever to its full open position **(1)**.
6. Raise and rotate the microprocessor retainer to its full open position **(2)**
7. Carefully lift the processor from the socket **(3)**.

△ **CAUTION:** Do NOT handle the pins in the processor socket. These pins are very fragile and handling them could cause irreparable damage. Once pins are damaged it may be necessary to replace the system board.

CAUTION: The heatsink must be installed within 24 hours of installing the processor to prevent damage to the processor's solder connections.



To install a new processor:

1. Place the processor in its socket and close the retainer.
2. Secure the locking lever.

   If reusing the existing heatsink, go to step 3.

   If using a new heatsink, go to step 6.
3. If reusing the existing heatsink, clean the bottom of the heatsink with the alcohol pad provided in the spares kit.
4. Apply the thermal grease provided in the spares kit to the top of the processor and install the heatsink atop the processor.

5. Go to step 7.
6. If using a new heatsink, remove the protective covering from the bottom of the heatsink and place it in position atop the processor.
7. Secure the heatsink to the system board and system board tray with the 4 captive screws and attach the heatsink control cable to the system board.

CAUTION: Heatsink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heatsink on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

NOTE: After installing a new processor onto the system board, always update the system ROM to ensure that the latest version of the BIOS is being used on the computer. The latest system ROM BIOS can be found on the Web at: http:///support/files.

Power Supply

NOTE: The appearance of the power supply varies based on model.

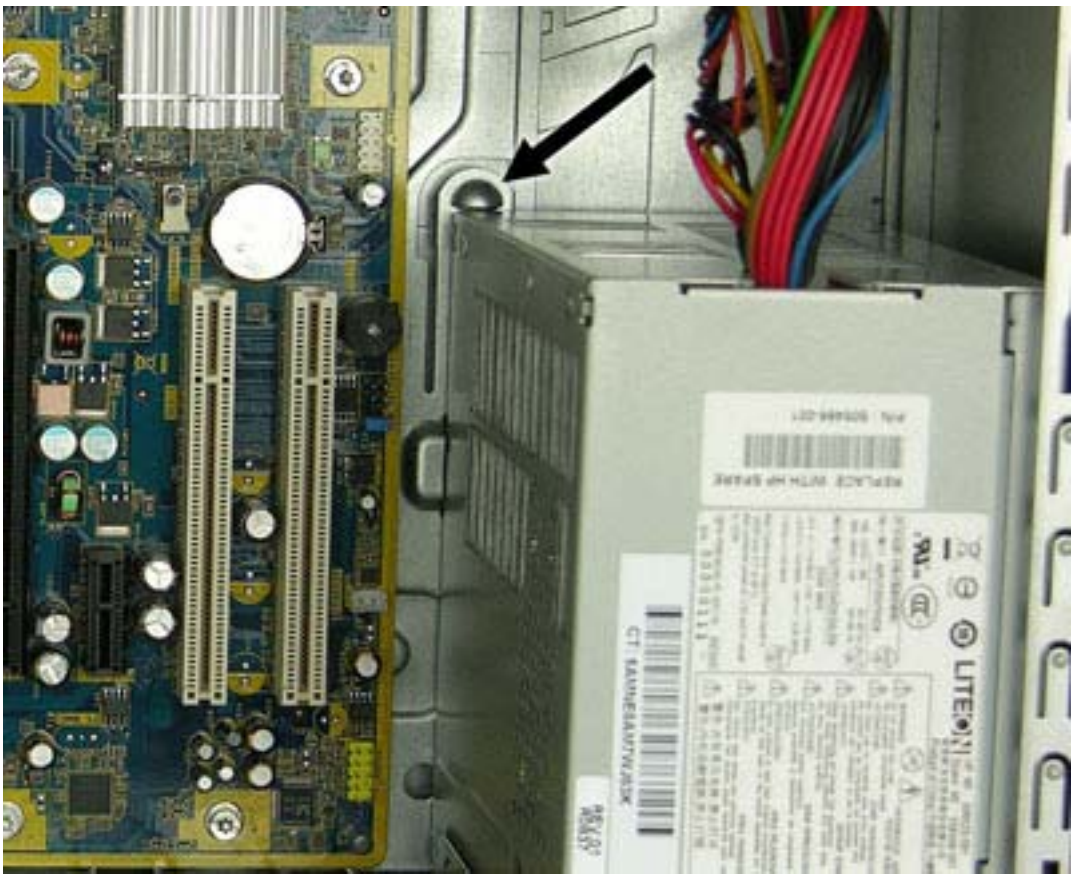
WARNING! Voltage is always present on the system board when the computer is plugged into an active AC outlet. To avoid possible personal injury and damage to the equipment the power cord should be disconnected from the computer and/or the AC outlet before opening the computer.

NOTE: When installing a new power supply, be sure to set the red switch to the setting (230 V or 115 V) appropriate for the country in which the computer is used. Spare power supplies normally arrive set for 230 V.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Lay the computer on its side with the rear facing toward you.
4. Disconnect all power cables from the mass storage devices and from the system board.

5. Remove the four screws that secure the power supply to the chassis.

6. Press the release latch on the chassis base, and then lift up the rear of the power supply to disengage it from the chassis.



7. Slide the power supply toward the front of the computer, then lift the power supply out of the computer.

To install the power supply, reverse the removal procedure.

System Board

When replacing the system board, be sure that the following components are removed from the defective system board and installed on the replacement system board:

- Memory modules
- Processor

1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).
3. Lay the computer on its side with the rear facing toward you.
4. Remove the front bezel (Front Bezel on page 39).
5. Remove an expansion cards (Expansion Cards on page 45).
6. Disconnect the power, and data cables from the back of all installed drives.

7. Disconnect all cables from the system board.

8. Remove the eight screws that secure the system board to the chassis.

9. Slide the system board toward the front of the chassis, and then lift it up and out of the chassis.

NOTE: The system board in the computer may look slightly different from the one shown here.

To install the system board, reverse the removal procedure.

NOTE: When replacing the system board, you must also change the chassis serial number in the BIOS.

NOTE: After installing a new system board, always update the system ROM to ensure that the latest version of the BIOS is being used on the computer. The latest system ROM BIOS can be found at: http:///support/files.

Battery

The battery that comes with your computer provides power to the real-time clock and has a lifetime of about three years. When replacing the battery, use a battery equivalent to the battery originally installed on the computer. The computer comes with a 3-volt lithium coin cell battery.

NOTE: The lifetime of the lithium battery can be extended by plugging the computer into a live AC wall socket. The lithium battery is only used when the computer is NOT connected to AC power.

WARNING! This computer contains an internal lithium manganese dioxide battery. There is a risk of fire and burns if the battery is not handled properly. To reduce the risk of personal injury:

- Do not attempt to recharge the battery.
- Do not expose to temperatures higher than 60°C (140°F)
- Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.
- Replace the battery only with the HP/Compaq spare designated for this product.

CAUTION: Before replacing the battery, it is important to back up the computer CMOS settings. When the battery is removed or replaced, the CMOS settings will be cleared. Refer to the *Troubleshooting Guide* for information on backing up the CMOS settings.

NOTE: Batteries, battery packs, and accumulators should not be disposed of together with the general household waste. In order to forward them to recycling or proper disposal, please use the public collection system or return them to HP, its authorized partners, or its agents.

CAUTION: Static electricity can damage the electronic components of the computer or optional equipment. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

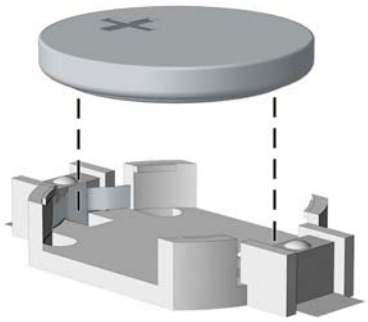
1. Prepare the computer for disassembly (Preparation for Disassembly on page 37).
2. Remove the access panel (Access Panel on page 38).

   NOTE: It may be necessary to remove an expansion card to gain access to the battery.

3. Locate the battery and battery holder on the system board.

Type 1 Battery Holder

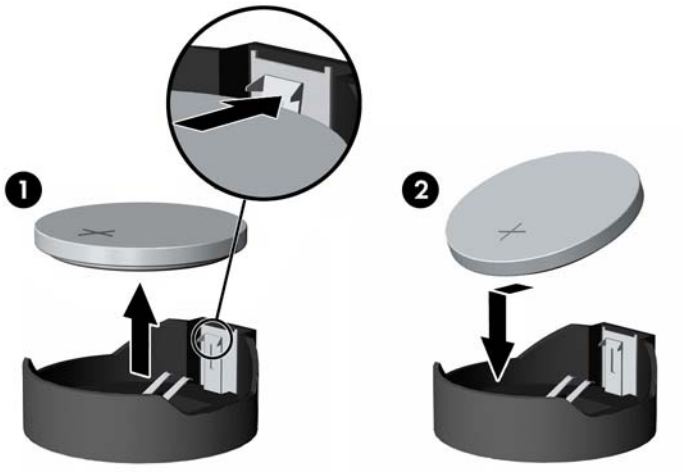
1. Lift the battery out of its holder.



2. Slide the replacement battery into position, positive side up.
3. The battery holder automatically secures the battery in the proper position.
4. Replace the computer access panel.
5. Plug in the computer and turn on power to the computer.
6. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

Type 2 Battery Holder

1. To release the battery from its holder, squeeze the metal clamp that extends above one edge of the battery. When the battery pops up, lift it out **(1)**.
2. To insert the new battery, slide one edge of the replacement battery under the holder's lip with the positive side up **(2)**. Push the other edge down until the clamp snaps over the other edge of the battery.

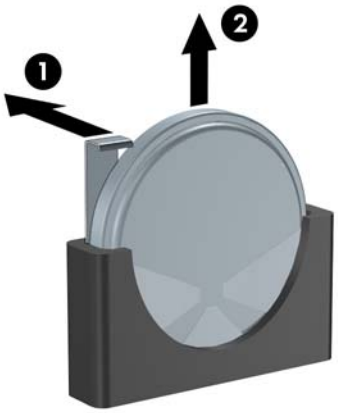


3. Replace the computer access panel.

4. Plug in the computer and turn on power to the computer.
5. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

Type 3 Battery Holder

1. Pull back on the clip **(1)** that holds the battery in place, then remove the battery **(2)**.
2. Insert the new battery and position the clip back in place.



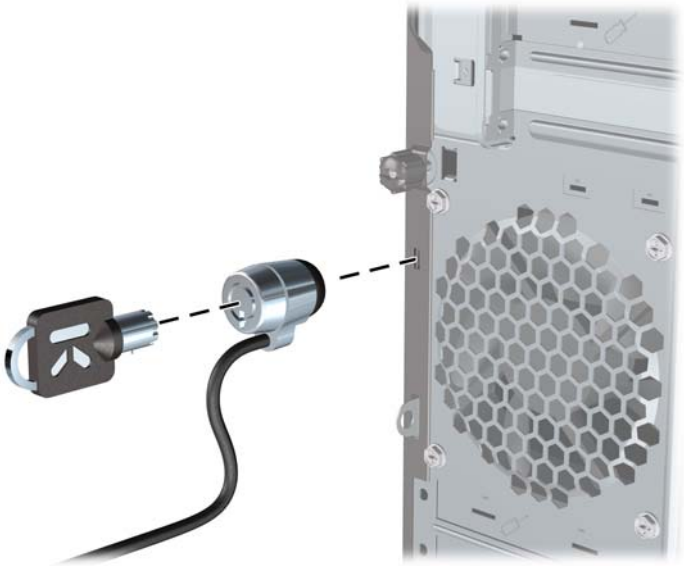
3. Replace the computer access panel.
4. Plug in the computer and turn on power to the computer.
5. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

Installing a Security Lock

The security locks displayed below and on the following pages can be used to secure the computer.

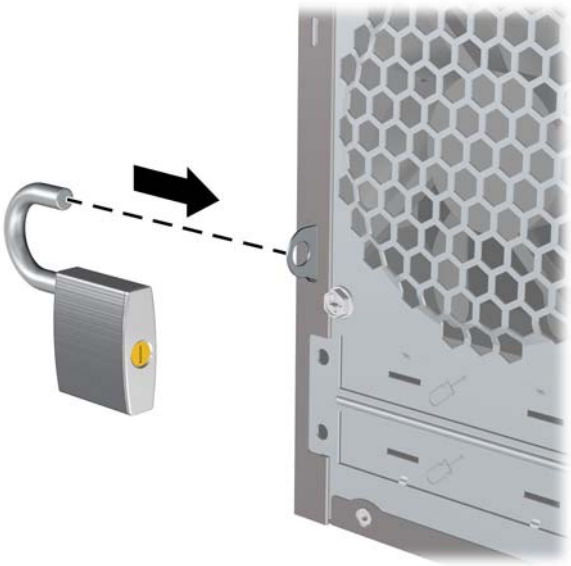
Cable Lock

Figure 7-35 Installing a Cable Lock



Padlock

Figure 7-36 Installing a Padlock



HP Business PC Security Lock

1. Fasten the security cable by looping it around a stationary object.

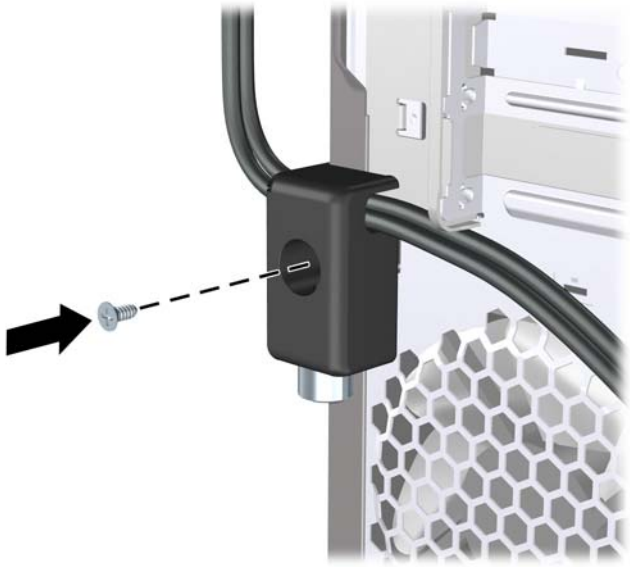
   Figure 7-37 Securing the Cable to a Fixed Object

2. Thread the keyboard and mouse cables through the lock.

   Figure 7-38 Threading the Keyboard and Mouse Cables

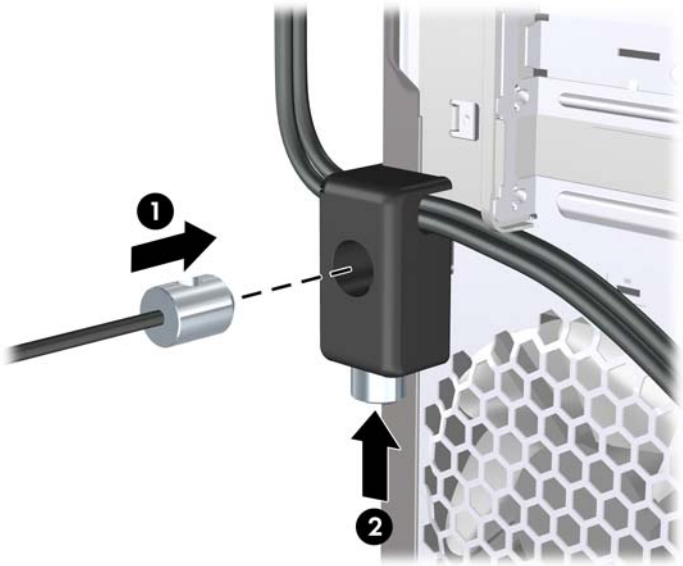
3. Screw the lock to the chassis using the screw provided.

Figure 7-39 Attaching the Lock to the Chassis



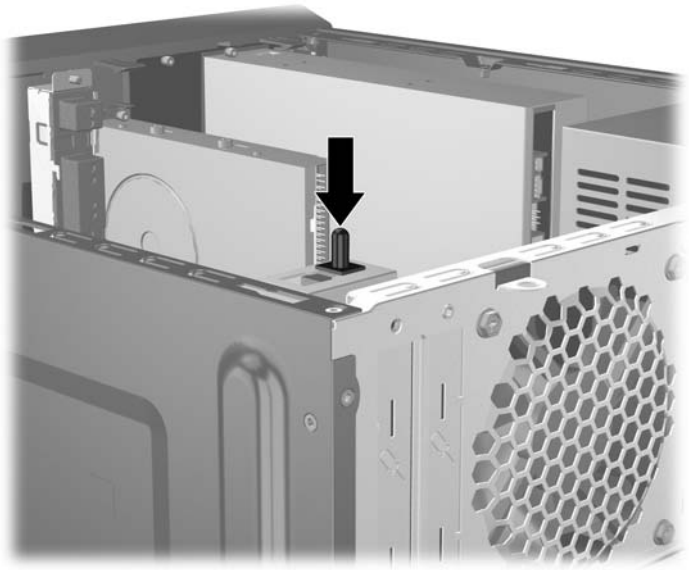
4. Insert the plug end of the security cable into the lock (1) and push the button in (2) to engage the lock. Use the key provided to disengage the lock.

Figure 7-40 Engaging the Lock



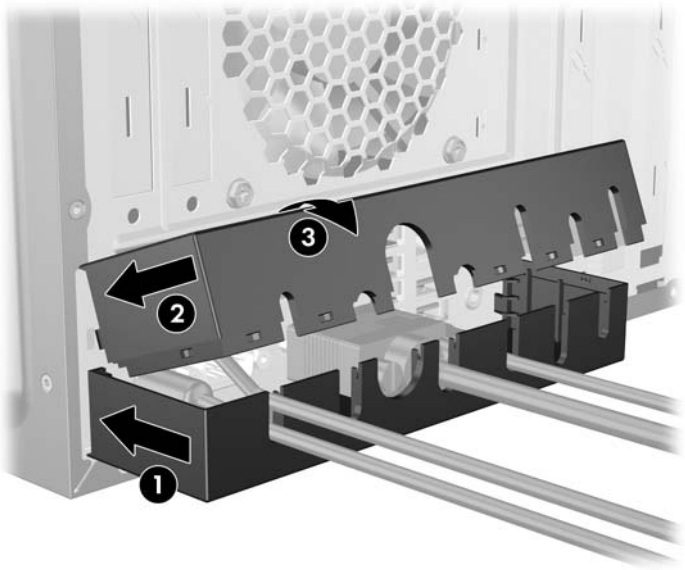
Hood Sensor

If the access panel is removed while there is still power to the computer, the hood sensor will cause the system to stop and display the Error 912 message after system reboot and will beep 5 times for 5 seconds. If the alarm sounds, close the access panel, tighten the thumbscrew, then reboot the system. The system will enter the operating system successfully. If the error message persists, press the F10 key immediately when the HP Logo screen is displayed to enter the Computer Setup menu. In the menu, select **Advanced** > **Hood Sensor** > **Reset Case Open Status** and make sure **Enable** is selected, then press the F10 key to Save and Exit, then reboot the system.



Port Cover

To install the port cover, slide the bottom half of the cover onto the chassis (1), then slide the top half of the cover onto the chassis at an angle (2) then rotate the top half down onto the bottom half (3). Ensure that the cables coming out of the rear of the computer are routed through the holes in the port cover.



8 Removal and Replacement Procedures Small Form Factor (SFF) Chassis

Adherence to the procedures and precautions described in this chapter is essential for proper service. After completing all necessary removal and replacement procedures, run the Diagnostics utility to verify that all components operate properly.

NOTE: Not all features listed in this guide are available on all computers.

Preparation for Disassembly

1. Close any open software applications.
2. Exit the operating system.
3. Remove any diskette or compact disc from the computer.
4. Turn off the computer and any peripheral devices that are connected to it.

CAUTION: Turn off the computer before disconnecting any cables.

Regardless of the power-on state, voltage is always present on the system board as long as the system is plugged into an active AC outlet. In some systems the cooling fan is on even when the computer is in the “Standby,” or “Suspend” modes. The power cord should always be disconnected before servicing a unit.

5. Disconnect the power cord from the electrical outlet and then from the computer.
6. Disconnect all peripheral device cables from the computer.

NOTE: During disassembly, label each cable as you remove it, noting its position and routing.

CAUTION: The screws used in the computer are of different thread sizes and lengths; using the wrong screw in an application may damage the unit.

Access Panel

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the thumbscrews that secure the access panel to the computer chassis **(1)**.
3. Slide the access panel back about 1.3 cm (1/2 inch), then lift it away from and off the unit **(2)**.

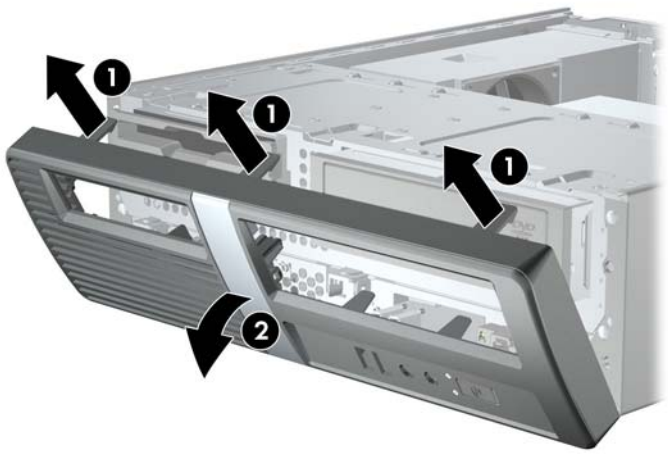
Figure 8-1 Removing the Access Panel

To install the access panel, reverse the removal procedure.

Front Bezel

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. To remove the front bezel, pull up on each of the three tabs on the top of the bezel **(1)** to release them, then rotate the bezel down and off the chassis **(2)**.

Figure 8-2 Removing the Front Bezel

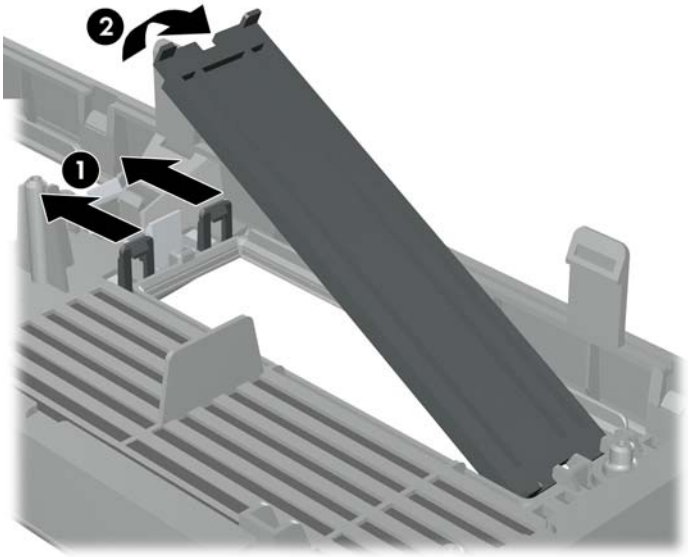


To install the front bezel, reverse the removal procedure.

Bezel Blanks

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the front bezel (Front Bezel on page 85).
4. While facing the inside of the front bezel, press the two retaining tabs on the right towards the outer edge of the bezel **(1)** and pull the bezel blank inwards to remove it **(2)**.

Figure 8-3 Removing a Bezel Blank



Cable Management

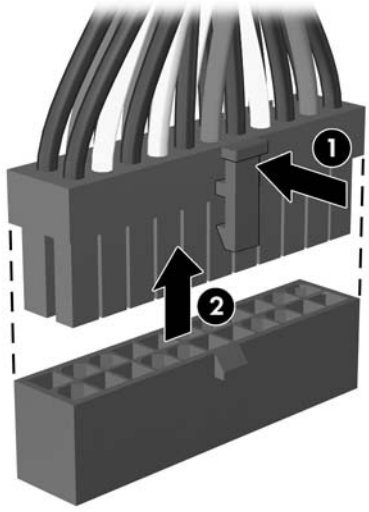
The Small Form Factor chassis is a very compact computer and proper routing of the internal cables is critical to the operation of the computer. Follow good cable management practices when working inside the computer.

- Keep cables away from major heat sources like the heatsink.
- Do not jam cables on top of expansion cards or memory modules. Printed circuit cards like these are not designed to take excessive pressure on them.
- Keep cables clear of movable or rotating parts like the power supply and drive cage to prevent them from being cut or crimped when the component is lowered into its normal position.
- When folding a flat ribbon cable, never fold to a sharp crease. Sharp creases may damage the wires.
- Some flat ribbon cables come prefolded. Never change the folds on these cables.
- Do not bend any cable sharply. A sharp bend can break the internal wires.
- Never bend a SATA data cable tighter than a 30 mm (1.18 in) radius.
- Never crease a SATA data cable.
- Do not rely on components like the drive cage, power supply, or access panel to push cables down into the chassis. Always position the cables to lay properly by themselves.

When removing the power supply power cables from the P1 connector on the system board, always follow these steps:

1. Squeeze on the top of the retaining latch attached to the cable end of the connector **(1)**.
2. Grasp the cable end of the connector and pull it straight up **(2)**.

△ **CAUTION:** Always pull the connector - NEVER pull on the cable. Pulling on the cable could damage the cable and result in a failed power supply.



Cable Connections

System board connectors are color-coded to make it easier to find the proper connection.

Cable	To	Cable Designator
Power Supply	Main power, 24-pin	P1
Power Supply	CPU power, 4-pin	P2
Power Supply	SATA Hard drive	P3
Power Supply	SATA Optical drive	P4

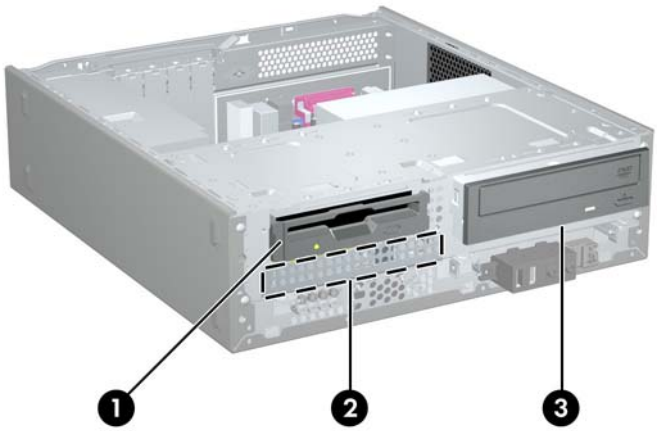
Connector Name	Connector Color	Description
F_PANEL	Black	Front LED/Power cable
SPEAKER	White	Speaker cable
FLOPPY	Black	Diskette drive
F_AUDIO	Yellow	Front audio cable
F_USB1	White	Front I/O USB cable
SATA1	Dark blue	Primary hard drive data cable
SATA2	White	Optical drive data cable
SATA3	Light blue	Optional drive
SATA4	Orange	Optional drive
CPU FAN	White	Heatsink fan cable
F_USB2	Black	Media card reader cable

Drives

A Torx T-15 screwdriver is needed to remove and install the guide screws on a drive.

Drive Positions

Figure 8-4 Drive Positions



1	3.5-inch external drive bay for optional drive (diskette drive shown)
2	3.5-inch internal hard drive bay
3	5.25-inch external drive bay for optional drive (optical drive shown)

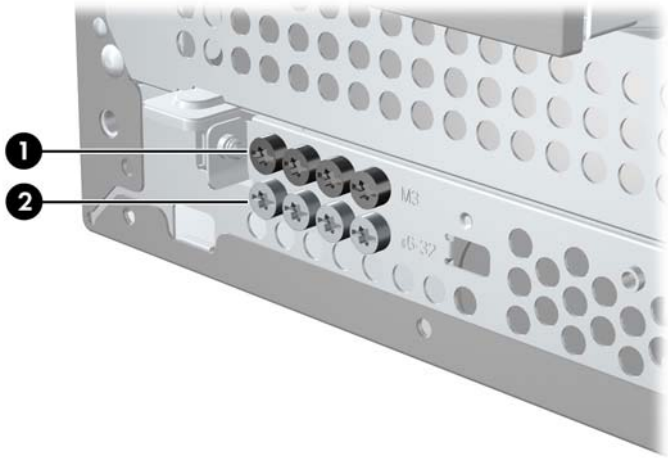
To verify the type, size, and capacity of the storage devices installed in the computer, run Computer Setup. Refer to the *Computer Setup (F10) Utility Guide* for more information.

Installing Additional Drives

When installing additional drives, follow these guidelines:

- The primary Serial ATA (SATA) hard drive must be connected to the dark blue primary SATA connector on the system board labeled SATA1.
- Connect the SATA optical drive to the white SATA connector on the system board labeled SATA2.
- Connect a diskette drive to the connector labeled FLOPPY.
- Connect a media card reader to the USB connector labeled F_USB2.
- The system does not support Parallel ATA (PATA) optical drives or PATA hard drives.
- You may install either a third-height or a half-height drive into a half-height bay.
- If needed, HP has provided extra drive retainer screws on the front of the chassis under the hard drive cage. Hard drives use 6-32 standard screws. All other drives use M3 metric screws. The HP-supplied M3 metric guide screws **(1)** are black. The HP-supplied 6-32 standard screws **(1)** are silver.

Figure 8-5 Extra Drive Retainer Screws Location



△ **CAUTION:** To prevent loss of work and damage to the computer or drive:

If you are inserting or removing a drive, shut down the operating system properly, turn off the computer, and unplug the power cord. Do not remove a drive while the computer is on or in standby mode.

Before handling a drive, ensure that you are discharged of static electricity. While handling a drive, avoid touching the connector.

Handle a drive carefully; do not drop it.

Do not use excessive force when inserting a drive.

Avoid exposing a hard drive to liquids, temperature extremes, or products that have magnetic fields such as monitors or speakers.

If a drive must be mailed, place the drive in a bubble-pack mailer or other protective packaging and label the package “Fragile: Handle With Care.”

System Board Drive Connections

Refer to the following illustration and table to identify the system board drive connectors.

Figure 8-6 System Board Drive Connections

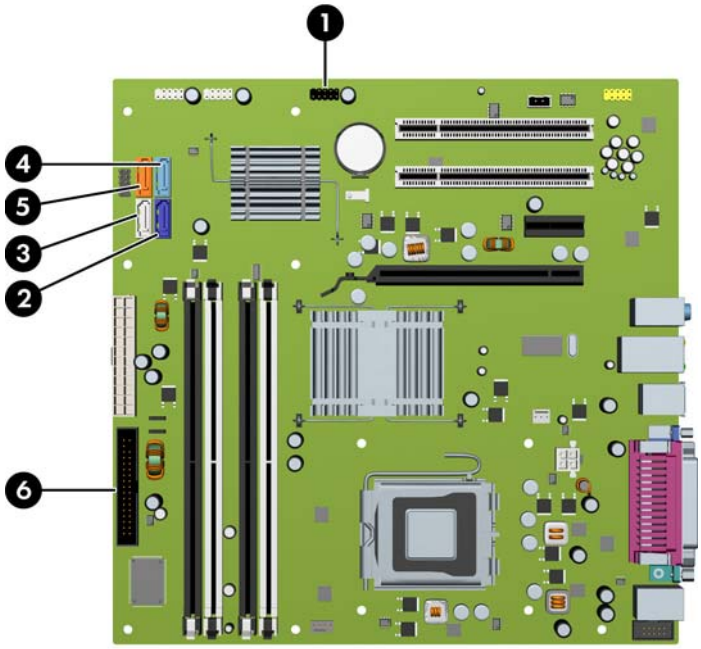


Table 8-1 System Board Drive Connections

No.	System Board Connector	System Board Label	Color
1	Media Card Reader	F_USB2	black
2	SATA1	SATA1	dark blue
3	SATA2	SATA2	white
4	SATA3	SATA3	light blue
5	SATA4	SATA4	orange
6	Diskette Drive	FLOPPY	black

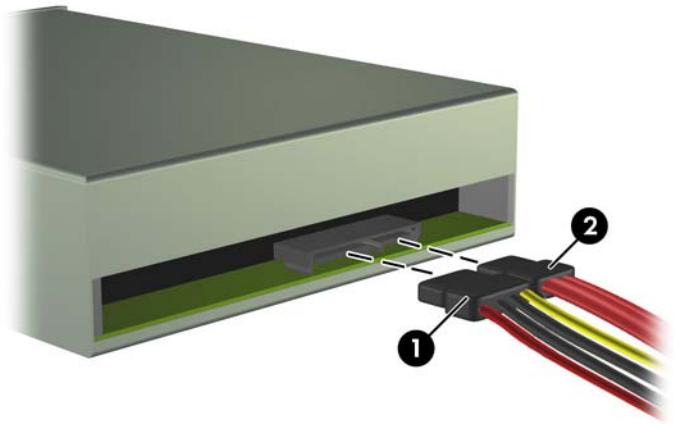
Removing an Optical Drive

△ **CAUTION:** All removable media should be taken out of a drive before removing the drive from the computer.

To remove an optical drive:

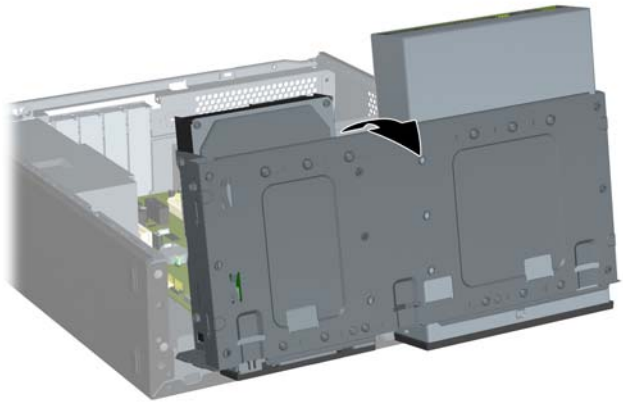
1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the front bezel (Front Bezel on page 85).
4. Disconnect the power cable **(1)** and data cable **(2)** from the rear of the optical drive.

Figure 8-7 Disconnecting the Power and Data Cables



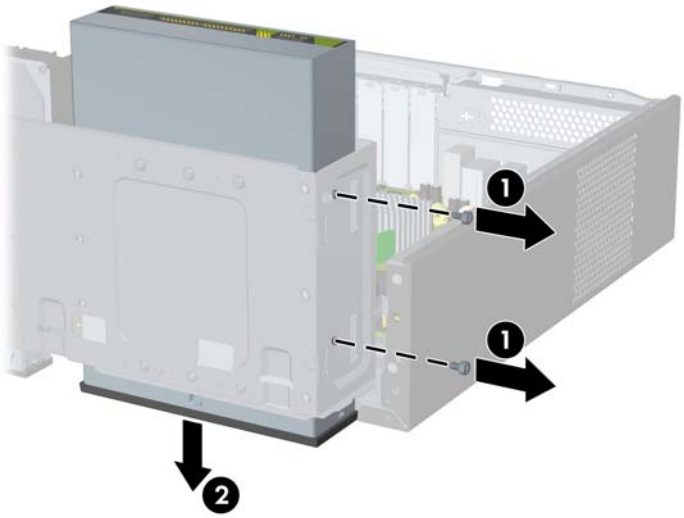
5. Rotate the drive cage all the way up.

Figure 8-8 Rotating the Drive Cage Up



6. Remove the two retainer screws that secure the drive to the bay **(1)** then slide the drive forward and out of the bay **(2)**.

Figure 8-9 Removing a 5.25-inch External Drive



Installing an Optical Drive into the 5.25-inch Drive Bay

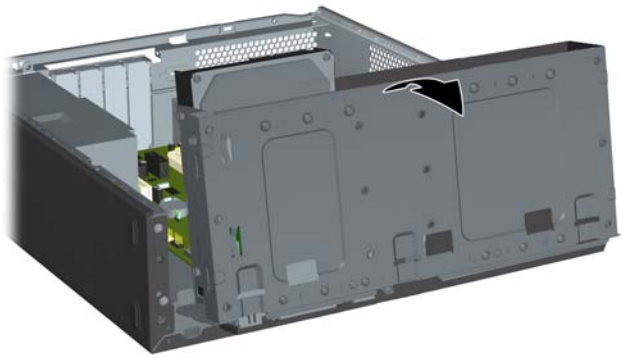
To install an optional 5.25-inch optical drive:

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the front bezel (Front Bezel on page 85).
4. If you are installing a drive in a bay covered by a bezel blank, remove the front bezel then remove the bezel blank.
5. Install the guide screw in the front top hole on the left side of the drive.

Figure 8-10 Installing the Guide Screw in the Optical Drive

6. Rotate the drive cage all the way up.

Figure 8-11 Rotating the Drive Cage Up

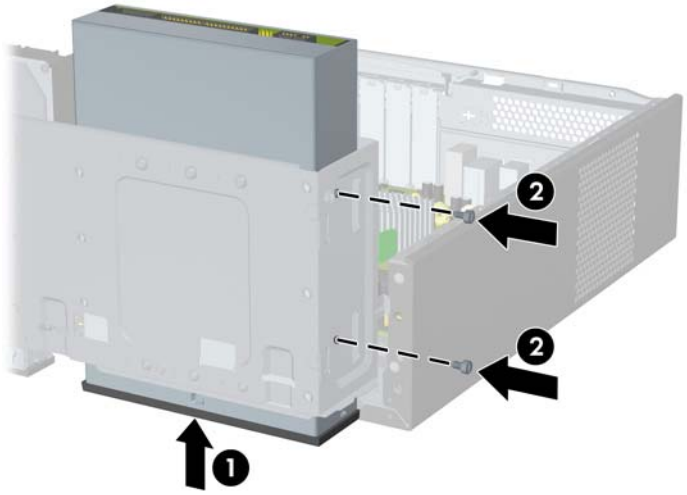


7. Align the guide screw on the drive with the slot on the chassis. Slide the optical drive into the drive bay until the two screw holes on the right side of the drive line up with the two screw holes on the right side of the drive cage **(1)**.

8. Secure the optical drive by fastening two retainer screws through the holes in the right side of the drive cage into the corresponding holes in the right side of the optical drive **(2)**.

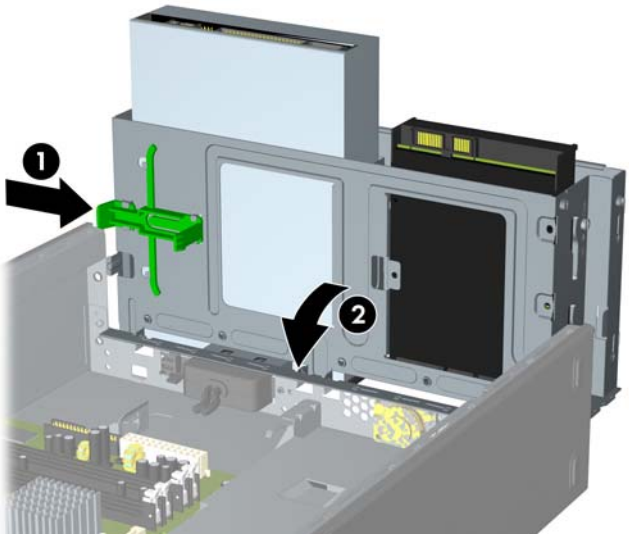
NOTE: Extra retainer screws are provided on the front of the chassis under the hard drive cage. The M3 metric retainer screws for optical drives are black.

Figure 8-12 Installing the Optical Drive



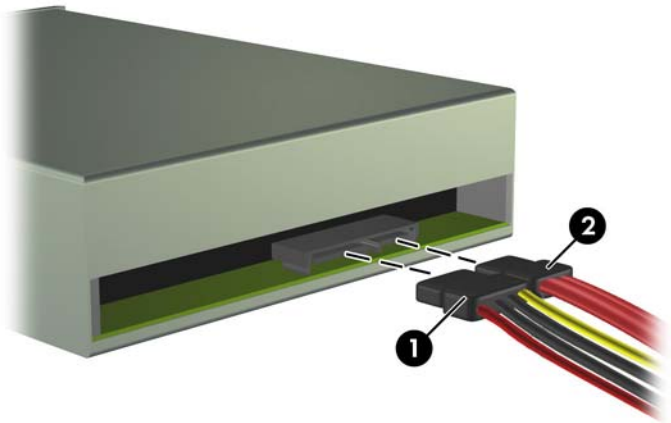
9. Push in the latch holding the drive cage upright **(1)** and lower the drive cage all the way down **(2)**.

Figure 8-13 Lowering the Drive Cage



10. Connect the SATA data cable to the red system board connector labeled SATA4.
11. Connect the power cable **(1)** and data cable **(2)** to the rear of the optical drive.

Figure 8-14 Connecting the Power and Data Cables



12. Replace the front bezel and access panel.
13. Reconnect the power cord and turn on the computer.
14. Lock any security devices that were disengaged when the access panel was removed.

The system automatically recognizes the drive and reconfigures the computer.

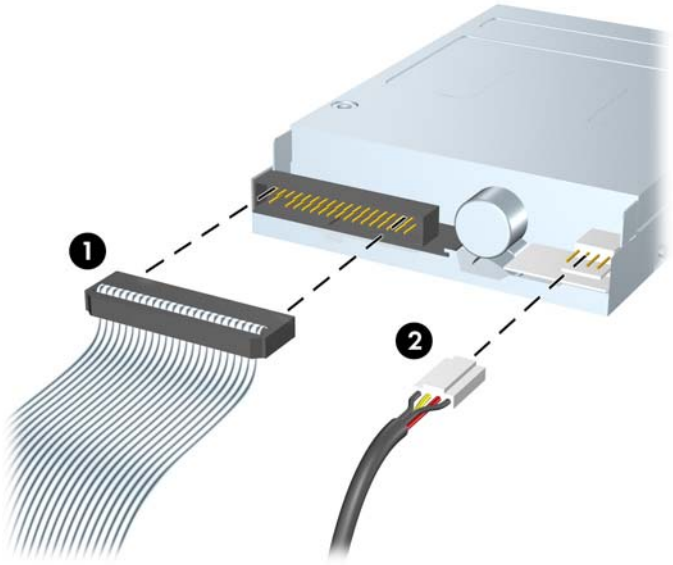
Removing an External 3.5-inch Drive

△ **CAUTION:** All removable media should be taken out of a drive before removing the drive from the computer.

NOTE: The 3.5-inch drive bay may contain a diskette drive or a media card reader.

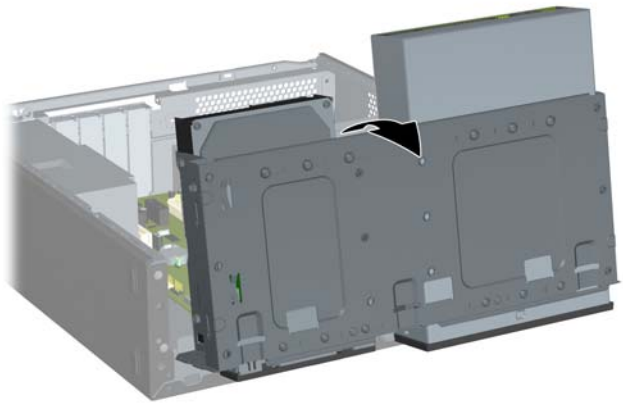
1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the front bezel (Front Bezel on page 85).
4. Disconnect the data cable **(1)** and power cable **(2)** from the rear of the drive.

Figure 8-15 Disconnecting the Diskette Drive Cables



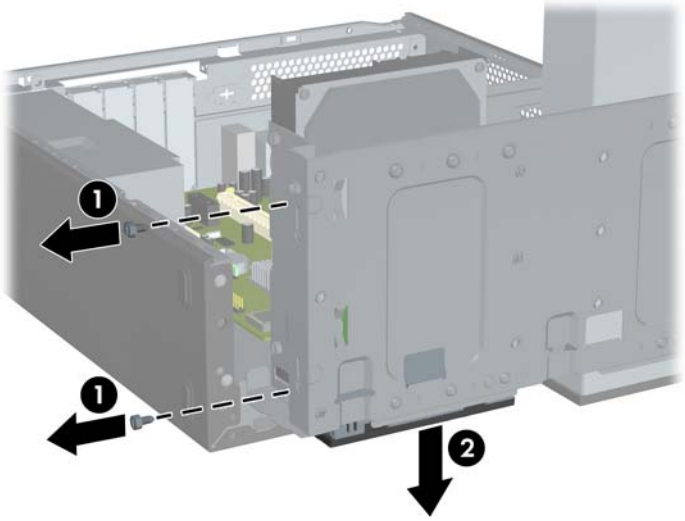
5. Rotate the drive cage all the way up.

Figure 8-16 Rotating the Drive Cage Up



6. Remove the two retainer screws that secure the drive to the bay **(1)** then slide the drive forward and out of the bay **(2)**.

Figure 8-17 Removing a 3.5-inch Device (Diskette Drive Shown)



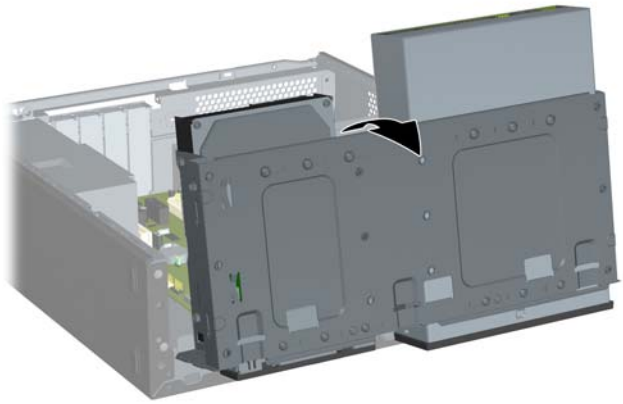
Installing a Drive into the 3.5-inch External Drive Bay

The 3.5-inch external drive bay on the front of the computer can be configured with a media card reader or a diskette drive.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the front bezel (Front Bezel on page 85).
4. If you are installing a diskette drive or media card reader in a bay covered by a bezel blank, remove the front bezel then remove the bezel blank.
5. If you are adding a drive to an empty drive bay for the first time, you must remove the knockout plate from the bay. To do so, insert a flat screwdriver into the knockout plate slot and rotate the screwdriver to break the knockout plate out of the chassis. Discard the knockout plate.
6. If the new drive has screws installed on the sides of the drive, remove them before inserting the drive into the chassis.

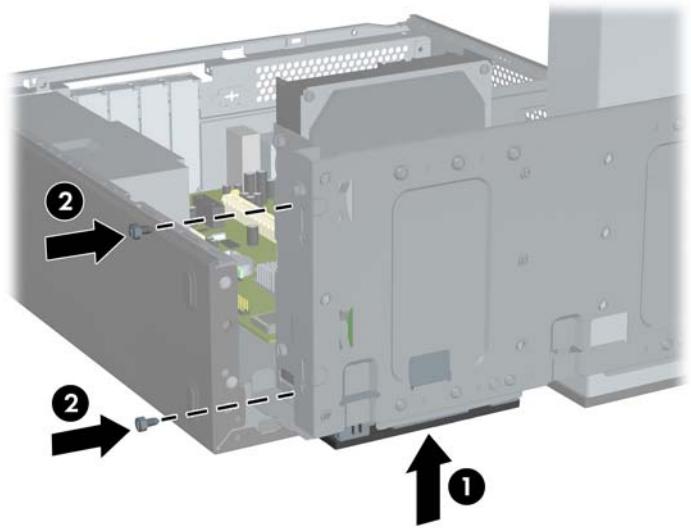
7. Rotate the drive cage all the way up.

Figure 8-18 Rotating the Drive Cage Up



8. Slide the drive into the drive bay **(1)** until the two screw holes on the left side of the drive line up with the two screw holes on the left side of the drive cage. Secure drive by fastening two retainer screws through the holes in the left side of the drive cage into the corresponding holes in the left side of the drive **(2)**.

Figure 8-19 Installing a 3.5-inch Device (Diskette Drive Shown)

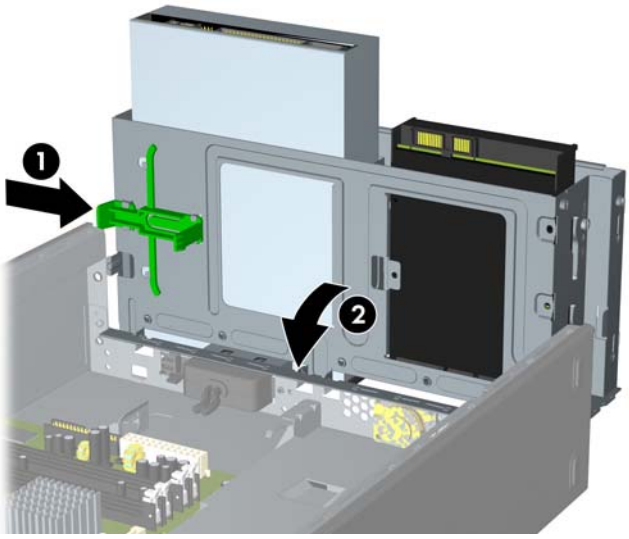


NOTE: The drive cage screw holes for each type of drive are labeled “CR” for media card reader or “FDD” for diskette drive.

Extra retainer screws are provided on the front of the chassis under the hard drive cage. The M3 metric retainer screws for diskette drives or media card readers are black.

9. Push in the latch holding the drive cage upright **(1)** and lower the drive cage all the way down **(2)**.

Figure 8-20 Lowering the Drive Cage



10. Connect the appropriate drive cables:

    a. If installing a diskette drive, connect the power and data cables to the rear of the drive and connect the other end of the data cable to the connector on the system board labeled FLOPPY.

    b. If installing a media card reader, connect the USB cable from the media card reader to the USB connector on the system board labeled F_USB2.

11. Replace the front bezel and access panel.

12. Reconnect the power cord and turn on the computer.

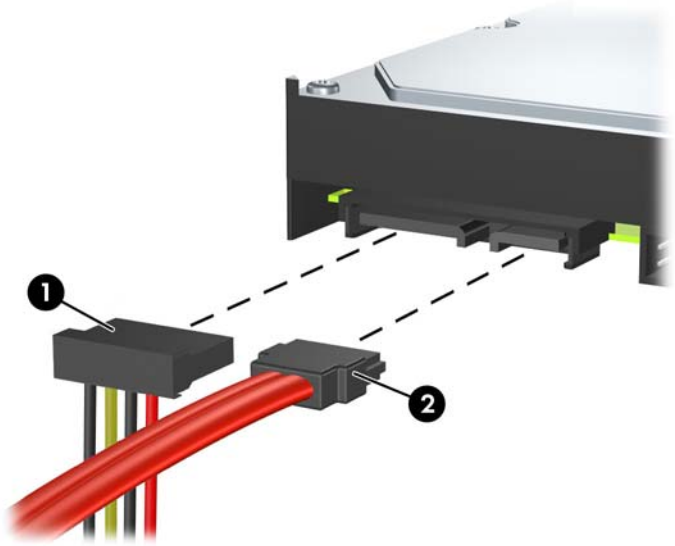
13. Lock any security devices that were disengaged when the access panel was removed.

Removing an Internal 3.5-inch Hard Drive

NOTE: Before you remove the old hard drive, be sure to back up the data from the old hard drive so that you can transfer the data to the new hard drive. Also, if you are replacing the primary hard drive, make sure you have created a Recovery Disc Set to restore the operating system, software drivers, and any software applications that were preinstalled on the computer. If you do not have this CD set, select **Start** > **HP Backup and Recovery** and create it now.

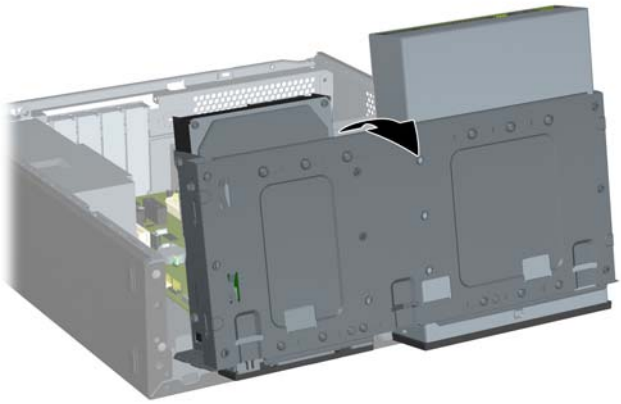
1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the front bezel (Front Bezel on page 85).
4. Disconnect the power cable **(1)** and data cable **(2)** from the back of the hard drive.

Figure 8-21 Disconnecting the Hard Drive Cables



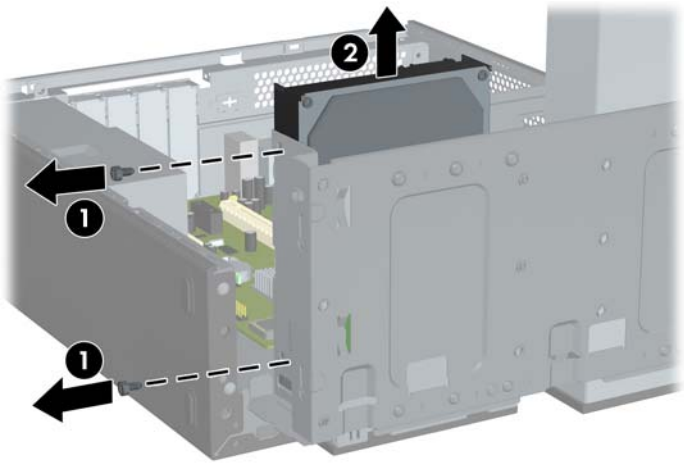
5. Rotate the drive cage all the way up.

Figure 8-22 Rotating the Drive Cage Up



6. Remove the two retainer screws that secure the drive to the bay **(1)** then slide the drive back and out of the bay **(2)**.

Figure 8-23 Removing an Internal Hard Drive



Installing an Internal 3.5-inch Hard Drive

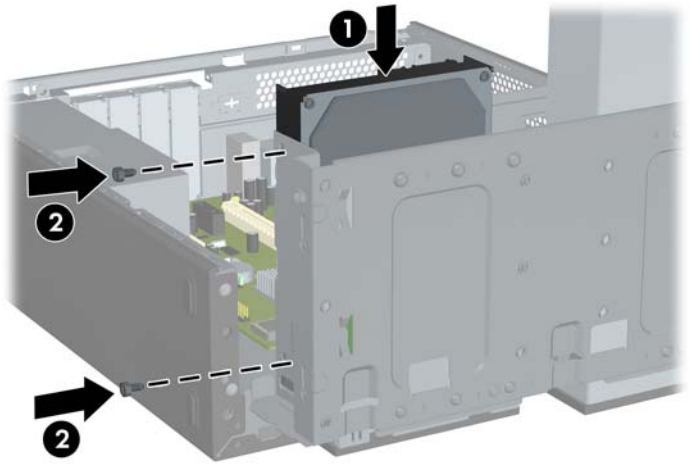
1. Remove the old hard drive.
2. Install the guide screw in the middle hole on the right side of the drive.

NOTE: When replacing a hard drive, remove the guide screws from the old drive for use with the new drive.

Figure 8-24 Installing the Guide Screw in the Hard Drive

3. Align the guide screw on the drive with the slot on the chassis. Slide the hard drive into the drive bay from the back until the two screw holes on the left side of the drive line up with the two screw holes on the left side of the drive cage **(1)**.
4. Secure the hard drive by fastening two retainer screws through the holes in the left side of the drive cage into the corresponding holes in the left side of the hard drive **(2)**.

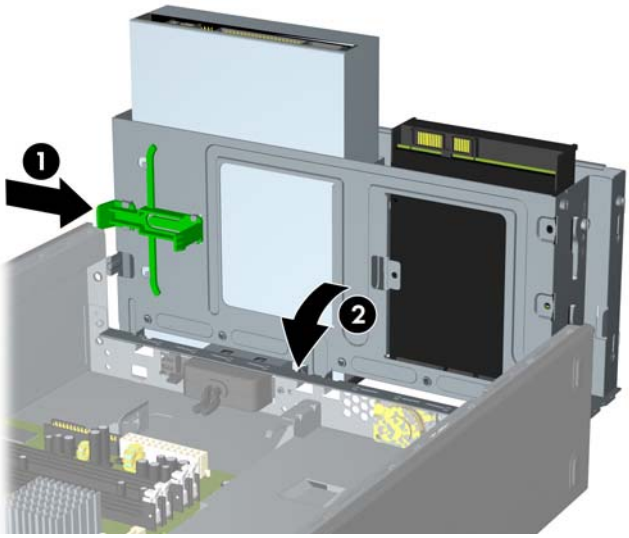
Figure 8-25 Installing an Internal Hard Drive



NOTE: Extra retainer screws are provided on the front of the chassis under the hard drive cage. The 6-32 retainer screws for hard drives are silver.

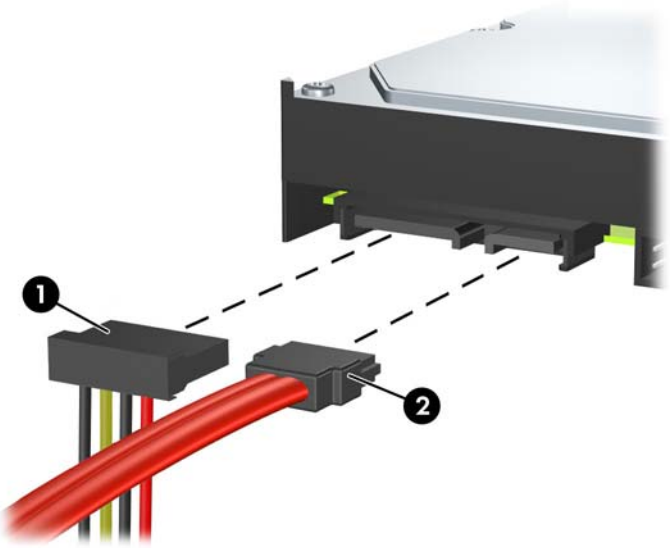
5. Push in the latch holding the drive cage upright and lower the drive cage all the way down.

Figure 8-26 Lowering the Drive Cage



6. Connect the power cable **(1)** and data cable **(2)** to the back of the hard drive.

Figure 8-27 Connecting the Hard Drive Cables



△ **CAUTION:** Never crease or bend a SATA data cable tighter than a 30 mm (1.18 in) radius. A sharp bend can break the internal wires.

7. Replace the access panel and front bezel.
8. Reconnect the power cord and any external devices, then turn on the computer.
9. Lock any security devices that were disengaged when the access panel was removed.

NOTE: If you are replacing the primary hard drive, use the Recovery Disc Set to restore the operating system, software drivers, and any software applications that were preinstalled on the computer.

Memory

The computer comes with double data rate 2 synchronous dynamic random access memory (DDR2-SDRAM) dual inline memory modules (DIMMs).

△ **CAUTION:** DDR and DDR2 memory modules are not interchangeable.

The memory sockets on the system board can be populated with up to four industry-standard DIMMs. These memory sockets are populated with at least one preinstalled DIMM. To achieve the maximum memory support, you can populate the system board with up to 8 GB of memory configured in a high-performing dual channel mode.

DDR2-SDRAM DIMMs

For proper system operation, the DDR2-SDRAM DIMMs must be:

- industry-standard 240-pin
- unbuffered PC2-6400 800 MHz-compliant
- 1.8 volt DDR2-SDRAM DIMMs

The DDR2-SDRAM DIMMs must also:

- support CAS latency 5 DDR2 800 Mhz (5-5-5 timing) and CAS latency 6 DDR2 800 Mhz (6-6-6 timing)
- contain the mandatory JEDEC SPD information

In addition, the computer supports:

- 512Mbit, 1Gbit, and 2Gbit non-ECC memory technologies
- single-sided and double-sided DIMMs
- DIMMs constructed with x8 and x16 DDR devices; DIMMs constructed with x4 SDRAM are not supported

NOTE: The system will not operate properly if you install unsupported DIMMs.

Populating DIMM Sockets

There are four DIMM sockets on the system board, with two sockets per channel. The sockets are labeled DIMM1, DIMM2, DIMM3, and DIMM4. Sockets DIMM1 and DIMM2 operate in memory channel A. Sockets DIMM3 and DIMM4 operate in memory channel B.

Figure 8-28 DIMM Socket Locations

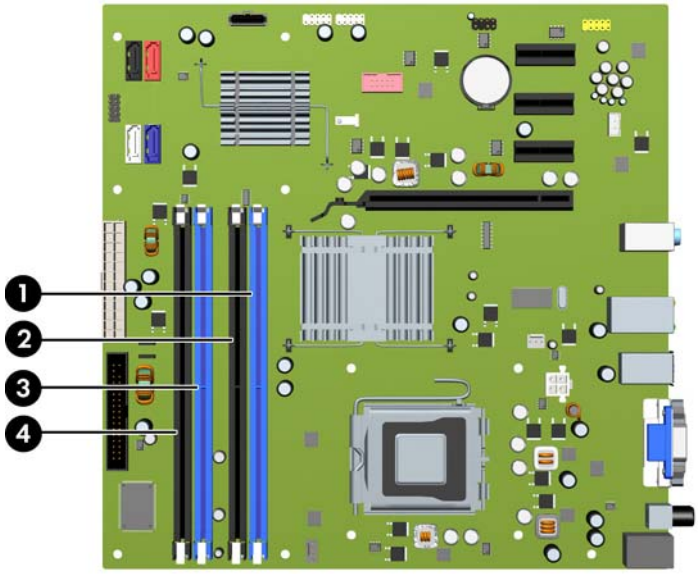


Table 8-2 DIMM Socket Locations

Item	Description	Socket Color
1	XMM1 socket, Channel A (populate first)	White
2	XMM2 socket, Channel A	Black
3	XMM3 socket, Channel B (populate second)	White
4	XMM4 socket, Channel B	Black
NOTE: A DIMM must occupy the XMM1 socket.		

The system will automatically operate in single channel mode, dual channel mode, or flex mode, depending on how the DIMMs are installed.

- The system will operate in single channel mode if the DIMM sockets are populated in one channel only.
- The system will operate in a higher-performing dual channel mode if the total memory capacity of the DIMMs in Channel A is equal to the total memory capacity of the DIMMs in Channel B. The technology and device width can vary between the channels. For example, if Channel A is populated with two 512-MB DIMMs and Channel B is populated with one 1-GB DIMM, the system will operate in dual channel mode.
- The system will operate in flex mode if the total memory capacity of the DIMMs in Channel A is not equal to the total memory capacity of the DIMMs in Channel B. In flex mode, the channel populated with the least amount of memory describes the total amount of memory assigned to dual channel

and the remainder is assigned to single channel. For optimal speed, the channels should be balanced so that the largest amount of memory is spread between the two channels. If one channel will have more memory than the other, the larger amount should be assigned to Channel A. For example, if you are populating the sockets with one 1-GB DIMM, and three 512-MB DIMMs, Channel A should be populated with the 1-GB DIMM and one 512-MB DIMM, and Channel B should be populated with the two 512-MB DIMMs. With this configuration, 2-GB will run as dual channel and 512-MB will run as single channel.

- In any mode, the maximum operational speed is determined by the slowest DIMM in the system.

Installing DIMMs

△ **CAUTION:** You must disconnect the power cord and wait approximately 30 seconds for the power to drain before adding or removing memory modules. Regardless of the power-on state, voltage is always supplied to the memory modules as long as the computer is plugged into an active AC outlet. Adding or removing memory modules while voltage is present may cause irreparable damage to the memory modules or system board.

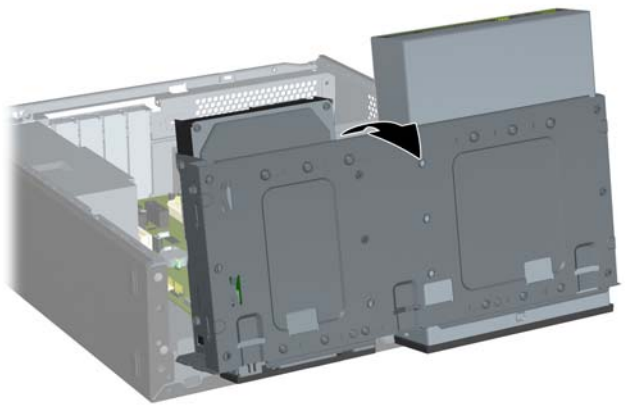
The memory module sockets have gold-plated metal contacts. When upgrading the memory, it is important to use memory modules with gold-plated metal contacts to prevent corrosion and/or oxidation resulting from having incompatible metals in contact with each other.

Static electricity can damage the electronic components of the computer or optional cards. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

When handling a memory module, be careful not to touch any of the contacts. Doing so may damage the module.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Rotate the drive cage all the way up.

Figure 8-29 Rotating the Drive Cage Up

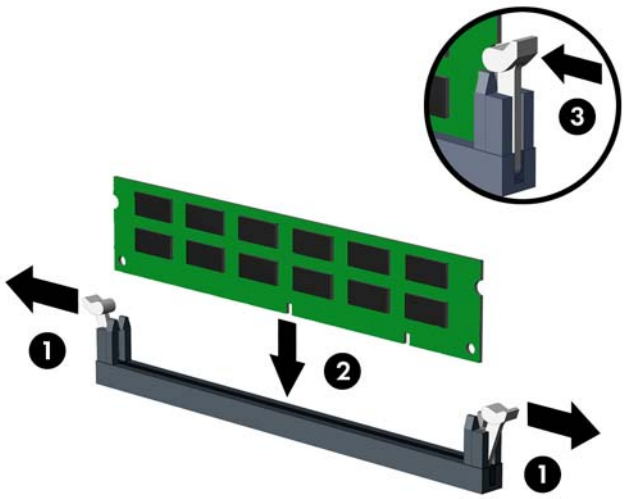


4. Locate the memory module sockets on the system board.

⚠ **WARNING!** To reduce risk of personal injury from hot surfaces, allow the internal system components to cool before touching.

5. Open both latches of the memory module socket **(1)**, and insert the memory module into the socket **(2)**.

Figure 8-30 Installing a DIMM



NOTE: A memory module can be installed in only one way. Match the notch on the module with the tab on the memory socket.

A DIMM must occupy the XMM1 socket. Always populate the white sockets before the black sockets in each channel.

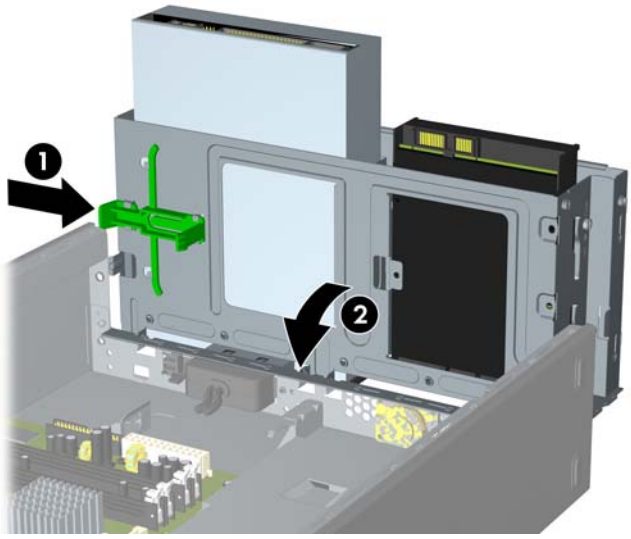
In order to create a dual-channel memory configuration, the memory capacity of Channel A must equal the memory capacity of Channel B. Refer to Populating DIMM Socketson page 105 for more information.

6. Push the DIMM module down firmly into the socket, ensuring that the module is fully inserted and properly seated. The DIMM must be pushed all the way down into the socket and sit evenly in the socket to avoid memory corruption. Make sure the latches are in the closed position **(3)**.

7. Repeat steps 5 and 6 to install any additional modules.

8. Push in the latch holding the drive cage upright **(1)** and lower the drive cage all the way down **(2)**.

Figure 8-31 Lowering the Drive Cage



9. Replace the computer access panel.
10. Reconnect the power cord and any external devices, then turn on the computer. The computer should automatically recognize the additional memory when you turn on the computer.
11. Lock any security devices that were disengaged when the access panel was removed.

Removing or Installing an Expansion Card

The computer has two standard PCI expansion slots, one PCI Express x1 expansion slot, and one PCI Express x16 expansion slot. The expansion slots accommodate full-height or half-height expansion cards.

Figure 8-32 Expansion Slot Locations

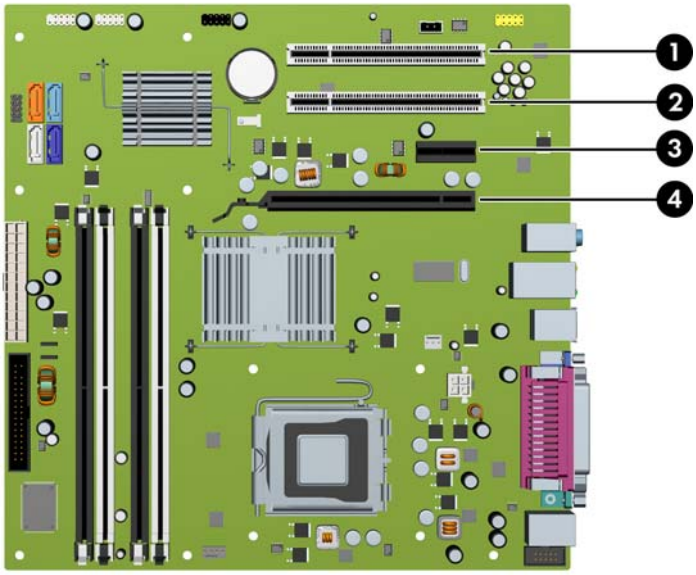


Table 8-3 Expansion Slot Locations

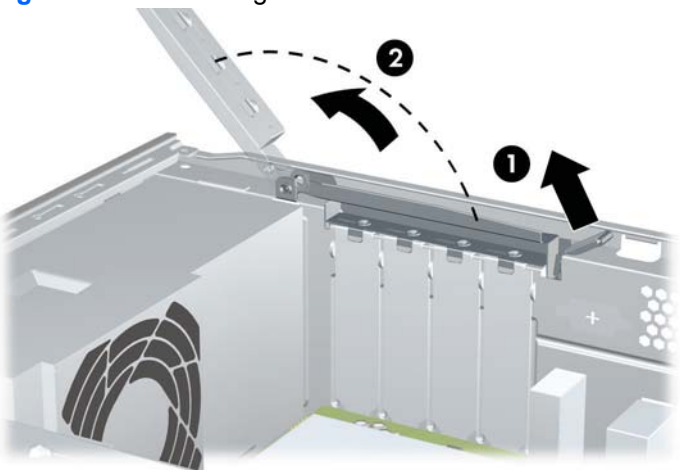
Item	Description
1	PCI expansion slot
2	PCI expansion slot
3	PCI Express x1 expansion slot
4	PCI Express x16 expansion slot

NOTE: You can install a PCI Express x1, x4, x8, or x16 expansion card in the PCI Express x16 expansion slot.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).

3. On the rear panel of the computer, lift the slot cover latch **(1)** and rotate slot cover up and away from the slots **(2)**.

Figure 8-33 Releasing the Slot Cover Lock

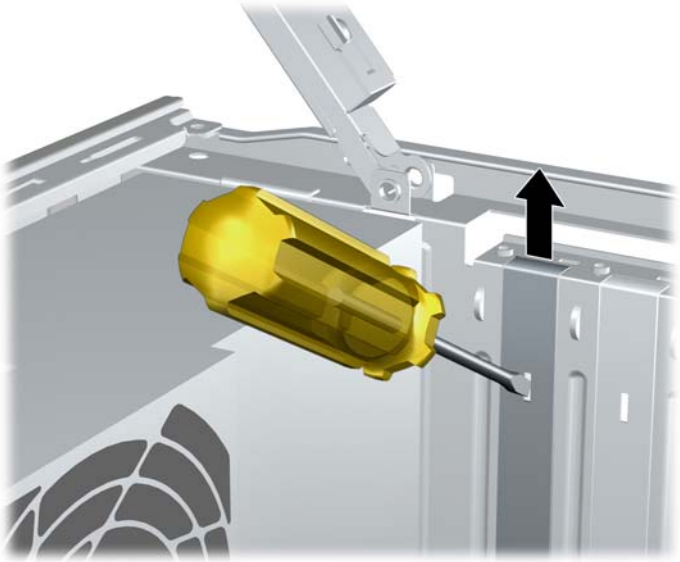


4. Before installing an expansion card, remove the expansion slot cover or the existing expansion card.

NOTE: Before removing an installed expansion card, disconnect any cables that may be attached to the expansion card.

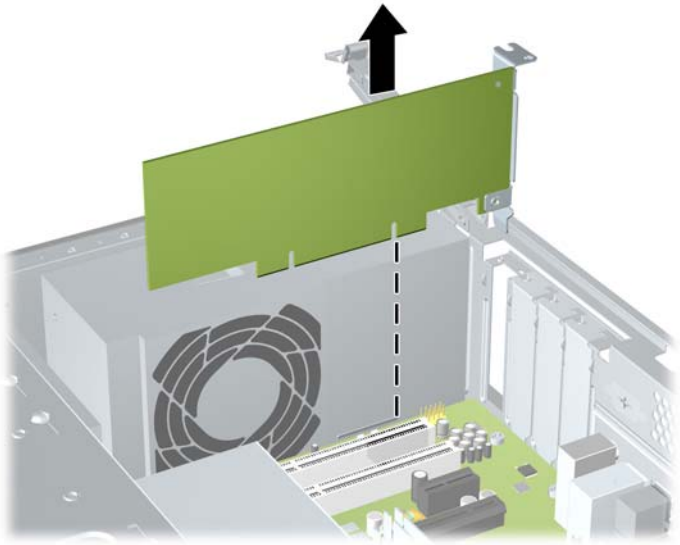
a. If you are installing an expansion card in a vacant socket, you must use a flat-blade screwdriver to pry out the metal shield on the rear panel that covers the expansion slot. Be sure to remove the appropriate shield for the expansion card you are installing.

Figure 8-34 Removing an Expansion Slot Cover



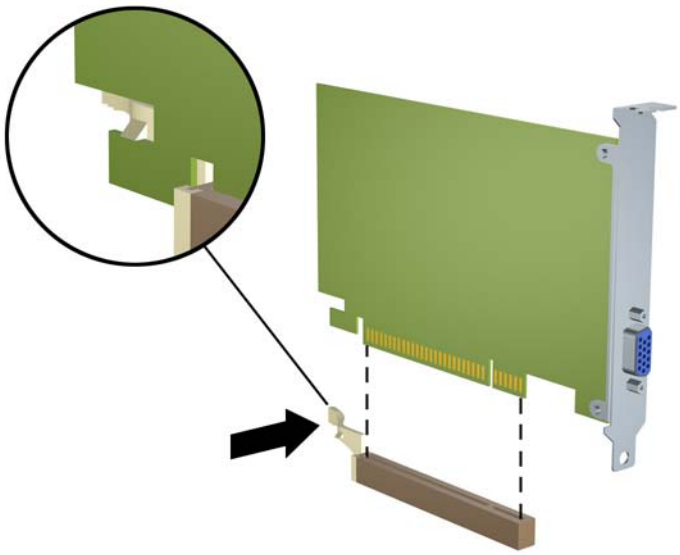
b. If you are removing a PCI or PCI Express x1 card, hold the card at each end and carefully rock it back and forth until the connectors pull free from the socket. Be sure not to scrape the card against the other components.

Figure 8-35 Removing a PCI or PCI Express x1 Expansion Card



c. If you are removing a PCI Express x16 card, pull the retention arm on the back of the expansion socket away from the card and carefully rock the card back and forth until the connectors pull free from the socket. Be sure not to scrape the card against the other components.

Figure 8-36 Removing a PCI Express x16 Expansion Card

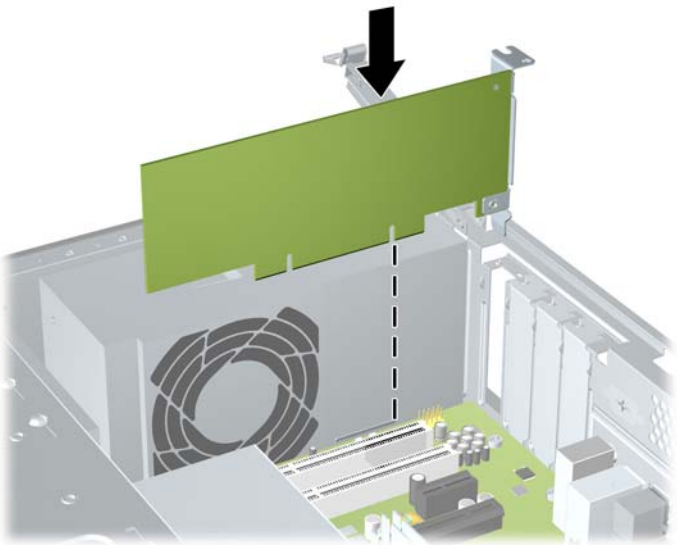


5. Store the removed card in anti-static packaging.
6. If you are not installing a new expansion card, install an expansion slot cover to close the open slot.

△ **CAUTION:** After removing an expansion card, you must replace it with a new card or expansion slot cover for proper cooling of internal components during operation.

7. To install a new expansion card, hold the card just above the expansion socket on the system board then move the card toward the rear of the chassis so that the bottom of the bracket on the card slides into the small slot on the chassis. Press the card straight down into the expansion socket on the system board.

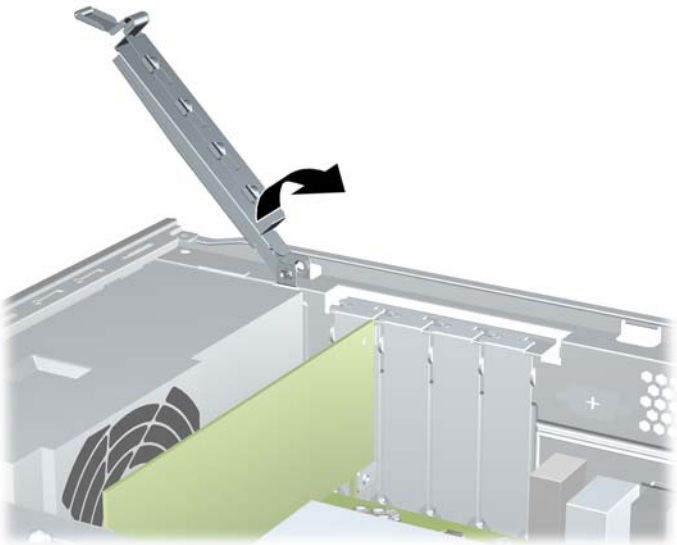
Figure 8-37 Installing an Expansion Card



NOTE: When installing an expansion card, press firmly on the card so that the whole connector seats properly in the expansion card slot.

8. While holding the expansion card bracket against the chassis, rotate the slot cover lock over the expansion card brackets and slot covers. Push the slot cover lock down to latch it and secure the card brackets.

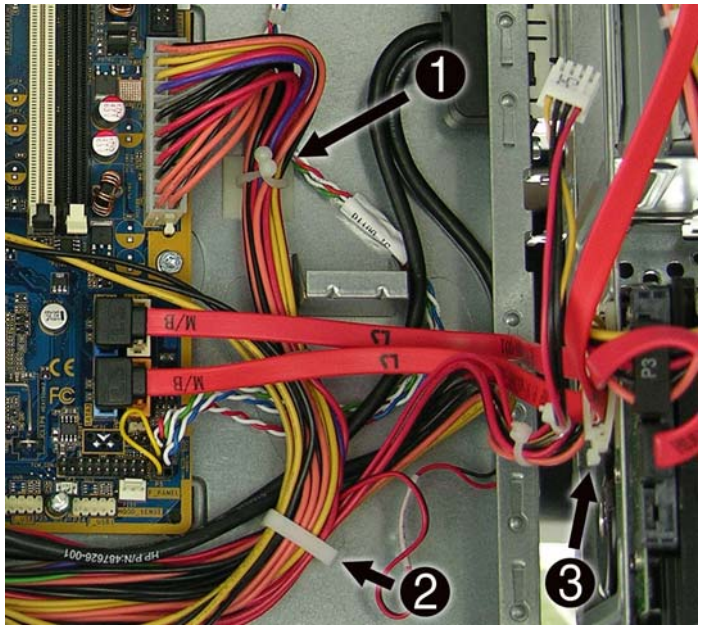
Figure 8-38 Closing the Slot Cover Lock



9. Connect external cables to the installed card, if needed. Connect internal cables to the system board, if needed.
10. Replace the computer access panel.
11. Reconfigure the computer, if necessary. Refer to the *Computer Setup (F10) Utility Guide* for instructions on using Computer Setup.

Plastic Wire/Cable Fastener and Clips

Three different plastic wire fasteners secure many of the system wires. You have to loosen these fasteners to gain access to the wires for several computer components. See the following illustration for proper routing of wires.



To loosen the fasteners:

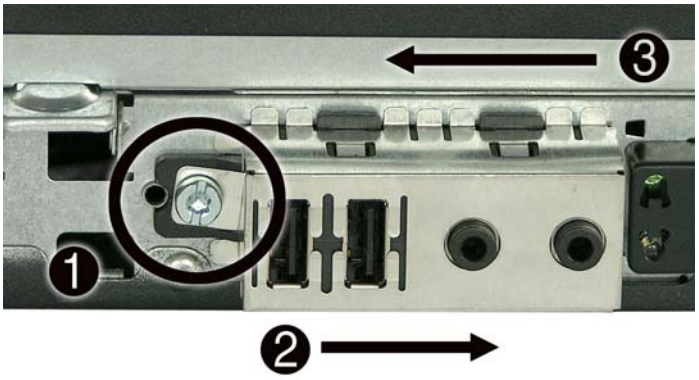
1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Rotate the drive cage to its upright position.
4. To open the round fastener **(1)**, twist the two ends of the fastener until the ends come apart.
5. To open the square fastener **(2)**, at the notch where the fastener latch connects, pull the top of the fastener up and outward.
6. To open the fastener mounted under the hard drive **(3)**, pull the latch on the right side of the fastener directly downward.

To close the fasteners, reverse the loosening procedure.

Front I/O Device

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the front bezel (Front Bezel on page 85).
4. Rotate the drive cage to its upright position.
5. Unplug the audio cable from the yellow system board connector labeled F_AUDIO.
6. Unplug the USB cable from the white system board connector labeled F_USB1.
7. Rotate the drive cage back down.
8. Remove the screw that secures the front I/O device to the chassis **(1)**.
9. Rotate the assembly toward the right side of the chassis **(2)**, and then slide the device slightly toward the left **(3)** to disengage the tab on the right side of the assembly from the chassis. Thread the wires through the hole in the chassis and remove the assembly.

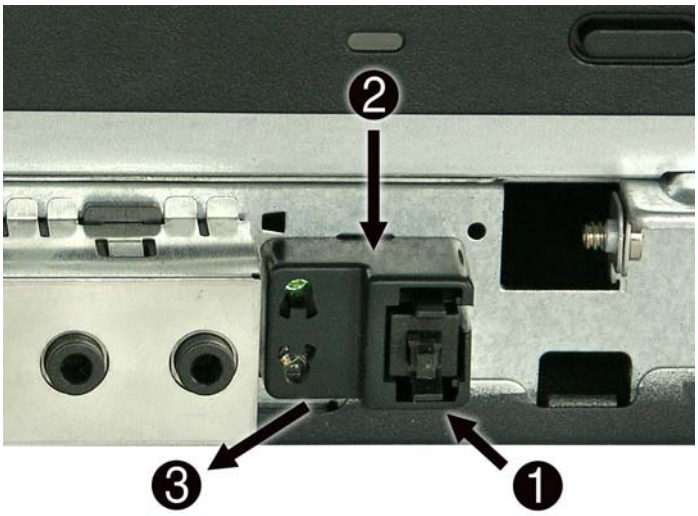
NOTE: If necessary, rotate the drive cage back up to better access the hole you thread the cables through.



To install the front I/O device, reverse the removal procedures.

Power Switch Assembly

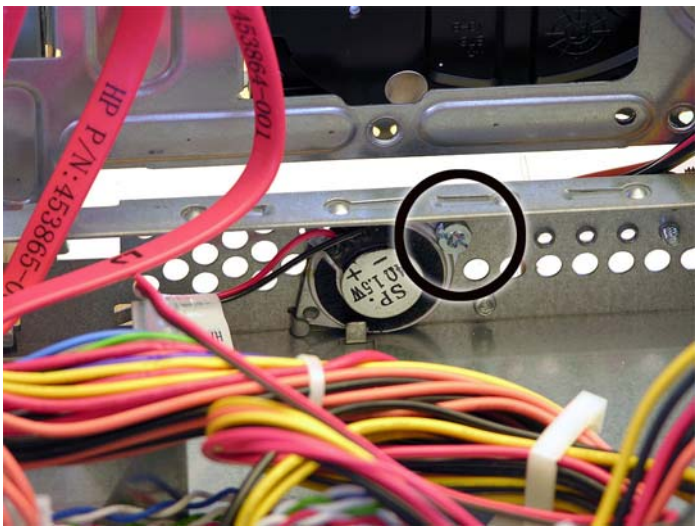
1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the front bezel (Front Bezel on page 85).
4. Rotate the drive cage to its upright position.
5. Disconnect the power switch wires from the black system board connector labeled F_PANEL.
6. Rotate the drive cage back down.
7. Press the tab on the bottom of the assembly to disengage it from the chassis **(1)**.
8. Slide the assembly downward to disengage the tab **(2)** on the top of assembly from the chassis.
9. If necessary, rotate the drive cage back up to gain access to the wires.
10. Pull the assembly out through front of unit **(3)** while threading the wires through the hole in the chassis.



To install the power switch assembly, reverse the removal procedure.

Speaker

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the front bezel (Front Bezel on page 85).
4. Rotate the drive cage to its upright position.
5. Loosen the square plastic fastener to gain access to the speaker wire.
6. Disconnect the speaker wire from the white system board connector labeled SPEAKER.
7. Remove the screw that secures the speaker to the inside of the chassis, slide the speaker away from the power switch, and then remove it from the chassis.

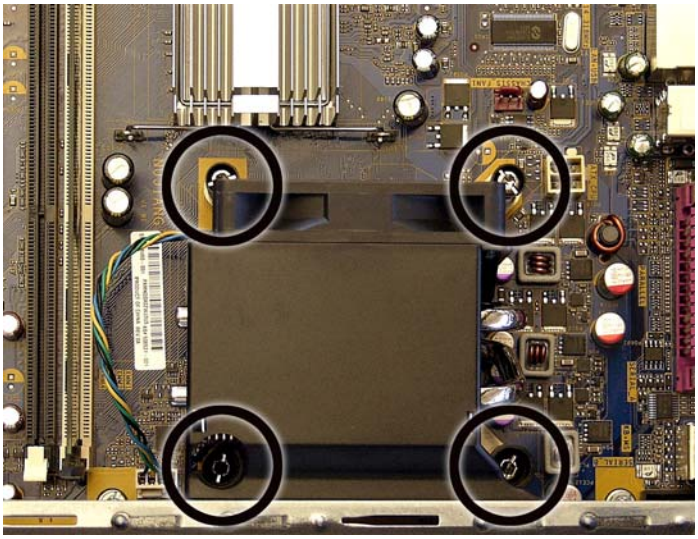


To install the speaker, reverse the removal procedures.

Heatsink

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Unplug the fan wire from the white system board connector labeled CPU FAN.
4. Loosen the four captive screws that secure the heatsink to the system board tray.

△ **CAUTION:** Heatsink retaining screws should be removed in diagonally opposite pairs (as in an X) to even the downward forces on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.



5. Lift the heatsink from atop the processor and set it on its side to keep from contaminating the work area with thermal grease.

When reinstalling the heatsink, make sure that its bottom has been cleaned with an alcohol wipe and fresh thermal grease has been applied to the top of the processor.

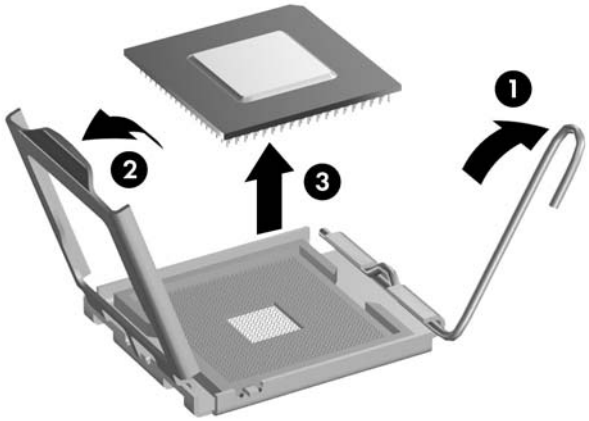
△ **CAUTION:** Heatsink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heatsink on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

Processor

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the heatsink (Heatsink on page 117).
4. Raise the locking lever to its fully open position **(1)**.
5. Raise and rotate the microprocessor retainer to its fully open position **(2)**.
6. Carefully lift the processor from the socket **(3)** labeled PROCESSOR.

△ **CAUTION:** Do NOT handle the pins in the processor socket. These pins are very fragile and handling them could cause irreparable damage. Once pins are damaged it may be necessary to replace the system board.

The heatsink must be installed within 24 hours of installing the processor to prevent damage to the processor's solder connections.



To install a new processor:

1. Place the processor in its socket and close the retainer.
2. Secure the locking lever. If reusing the existing heatsink, go to step 3. If using a new heatsink, go to step 6.
3. If reusing the existing heatsink, clean the bottom of the heatsink with the alcohol pad provided in the spares kit.

△ **CAUTION:** Before reinstalling the heatsink you must clean the top of the processor and the bottom of the heatsink with an alcohol pad supplied in the spares kit. After the alcohol has evaporated, apply thermal grease to the top of the processor from the syringe supplied in the spares kit.

4. Apply the thermal grease provided in the spares kit to the top of the processor and install the heatsink atop the processor.

5. Go to step 7.
6. If using a new heatsink, remove the protective covering from the bottom of the heatsink and place it in position atop the processor.
7. Secure the heatsink to the system board and system board tray with the four captive screws and attach the heatsink control cable to the system board.

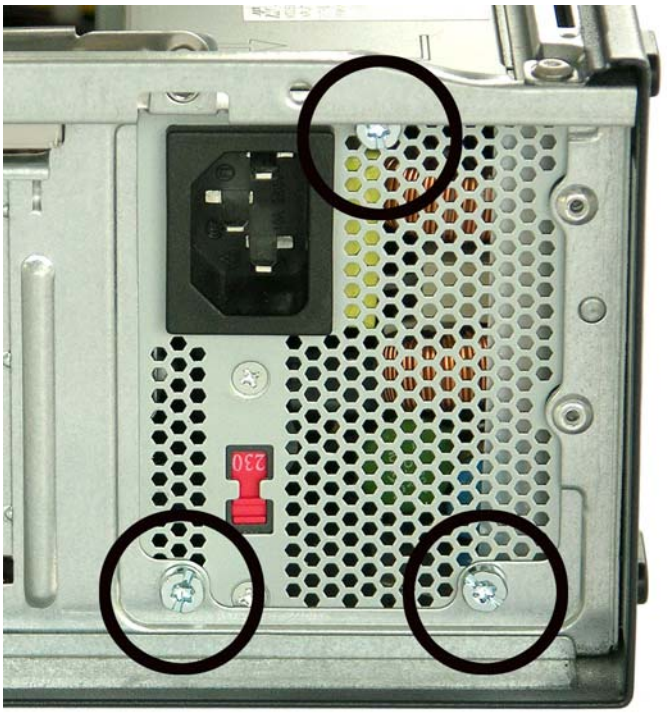
△ **CAUTION:** Heatsink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heatsink on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

NOTE: After installing a new processor onto the system board, always update the system ROM to ensure that the latest version of the BIOS is being used on the computer. The latest system BIOS can be found on the Web at: http://h18000.www1.hp.com/support/files.

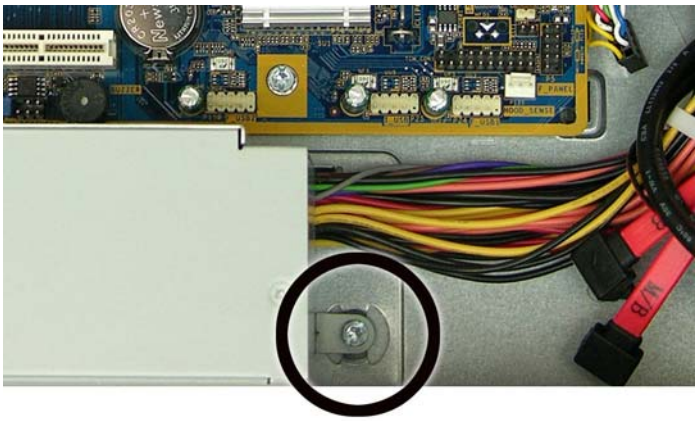
Power Supply

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the front bezel (Front Bezel on page 85).
4. Rotate the drive cage to its upright position.
5. Open the plastic cable fasteners so you can remove the wires from them (Plastic Wire/Cable Fastener and Clips on page 113).
6. Unplug all power supply wires from the system board and the drives, noting their locations for reinstallation.

7. Remove the three screws that secure the power supply to the back of the chassis.



8. Remove the screw that secures the power supply to the base of the computer.

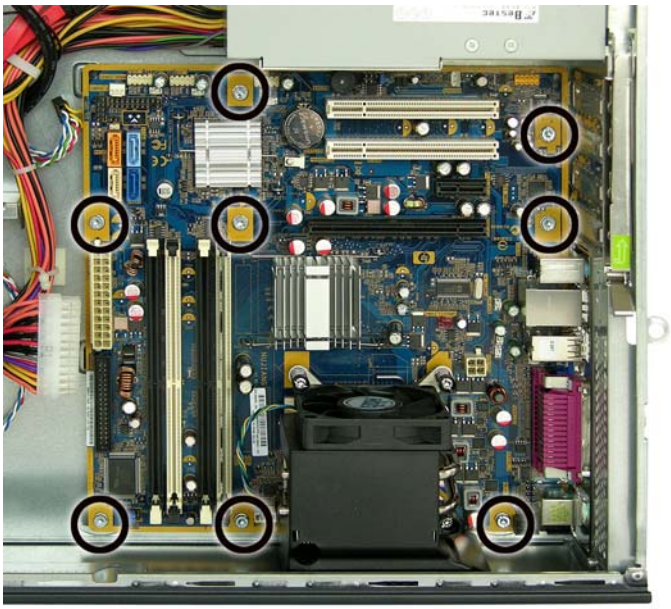


9. Slide the power supply about 1.25 cm (1/2-inch) toward the front of the chassis, rotate the power supply toward the heatsink so it clears the lip at the top of the chassis, and then lift the power supply out of the chassis.

To install the power supply, reverse the removal procedure.

System Board

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the access panel (Access Panel on page 84).
3. Remove the front bezel (Front Bezel on page 85).
4. Loosen the plastic cable fasteners (Plastic Wire/Cable Fastener and Clips on page 113).
5. Remove all PCI and PCI Express expansion boards (Removing or Installing an Expansion Card on page 109).
6. Remove all memory modules (Memory on page 104).
7. Disconnect all data and power cables from the system board.
8. Remove the heatsink (Heatsink on page 117).
9. Remove the power supply (Power Supply on page 119).
10. Remove the eight screws that secure the system board to the chassis, slide the board about 1.25 cm (1/2 inch) toward the front of the chassis, and then lift the board out of the chassis.



To install the system board, reverse the removal procedure.

△ **CAUTION:** Before reinstalling the heatsink you must clean the top of the processor and the bottom of the heatsink with an alcohol pad supplied in the spares kit. After the alcohol has evaporated, apply thermal grease to the top of the processor from the syringe supplied in the spares kit.

CAUTION: When reconnecting the cables it is important that they be positioned so they do not interfere with the rotation of the drive cage or power supply.

NOTE: When replacing the system board, you must also change the chassis serial number in the BIOS.

Battery

The battery that comes with your computer provides power to the real-time clock and has a lifetime of about three years. When replacing the battery, use a battery equivalent to the battery originally installed on the computer. The computer comes with a 3-volt lithium coin cell battery.

NOTE: The lifetime of the lithium battery can be extended by plugging the computer into a live AC wall socket. The lithium battery is only used when the computer is NOT connected to AC power.

WARNING! This computer contains an internal lithium manganese dioxide battery. There is a risk of fire and burns if the battery is not handled properly. To reduce the risk of personal injury:

Do not attempt to recharge the battery.

Do not expose to temperatures higher than 140°F (60°C).

Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.

Replace the battery only with the HP spare designated for this product.

CAUTION: Before replacing the battery, it is important to back up the computer CMOS settings. When the battery is removed or replaced, the CMOS settings will be cleared. Refer to the *Computer Setup (F10) Utility Guide* for information on backing up the CMOS settings.

NOTE: HP encourages customers to recycle used electronic hardware, HP original print cartridges, and rechargeable batteries. For more information about recycling programs, go to http://www.hp.com/recycle.

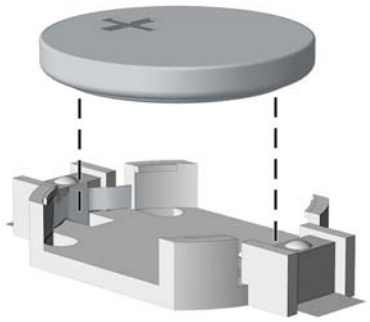
CAUTION: Static electricity can damage the electronic components of the computer or optional equipment. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 83).
2. Remove the computer access panel (Access Panel on page 84).

   NOTE: It may be necessary to remove an expansion card to gain access to the battery.
3. Locate the battery and battery holder on the system board.
4. Carefully pull the cable bundle out of the way to access the battery.
5. Depending on the type of battery holder on your system board, complete the following instructions to replace the battery:

Type 1 Battery Holder

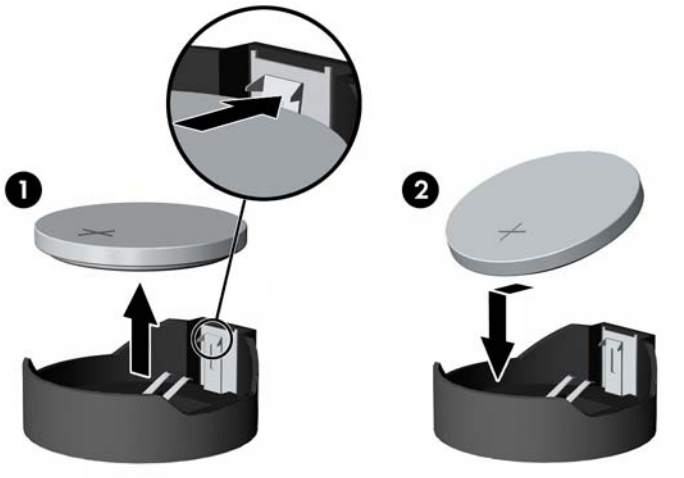
1. Lift the battery out of its holder.



2. Slide the replacement battery into position, positive side up.
3. The battery holder automatically secures the battery in the proper position.
4. Replace the computer access panel.
5. Plug in the computer and turn on power to the computer.
6. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

Type 2 Battery Holder

1. To release the battery from its holder, squeeze the metal clamp that extends above one edge of the battery. When the battery pops up, lift it out **(1)**.
2. To insert the new battery, slide one edge of the replacement battery under the holder's lip with the positive side up **(2)**. Push the other edge down until the clamp snaps over the other edge of the battery.

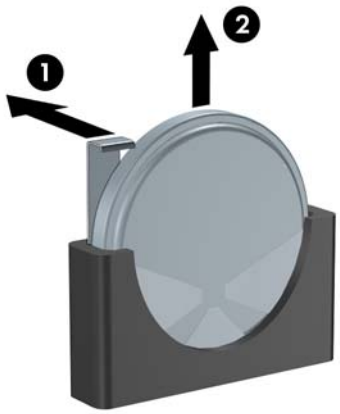


3. Replace the computer access panel.

4. Plug in the computer and turn on power to the computer.
5. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

Type 3 Battery Holder

1. Pull back on the clip **(1)** that holds the battery in place, then remove the battery **(2)**.
2. Insert the new battery and position the clip back in place.



3. Replace the computer access panel.
4. Plug in the computer and turn on power to the computer.
5. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

Installing a Security Lock

The security locks displayed below and on the following page can be used to secure the computer.

Cable Lock

Figure 8-39 Installing a Cable Lock

Padlock

Figure 8-40 Installing a Padlock

HP Business PC Security Lock

1. Fasten the security cable by looping it around a stationary object.

   Figure 8-41 Securing the Cable to a Fixed Object

2. Thread the keyboard and mouse cables through the lock.

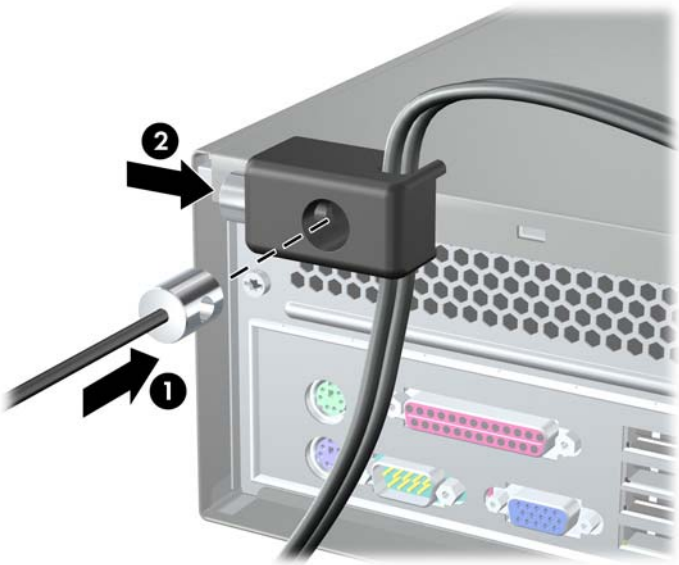
   Figure 8-42 Threading the Keyboard and Mouse Cables

3. Remove the left screw that secures the computer access panel to the chassis and screw the lock to the chassis using the screw provided.

Figure 8-43 Attaching the Lock to the Chassis

4. Insert the plug end of the security cable into the lock **(1)** and push the button in **(2)** to engage the lock. Use the key provided to disengage the lock.

Figure 8-44 Engaging the Lock



A Connector Pin Assignments

This appendix contains the pin assignments for many computer and workstation connectors. Some of these connectors may not be used on the product being serviced.

Keyboard

Connector and Icon	Pin	Signal
	1	Data
	2	Unused
	3	Ground
	4	+5 VDC
	5	Clock
	6	Unused

Mouse

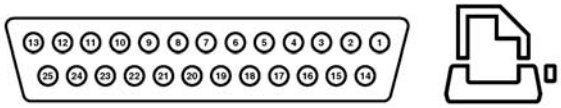
Connector and Icon	Pin	Signal
	1	Data
	2	Unused
	3	Ground
	4	+5 VDC
	5	Clock
	6	Unused

Ethernet BNC

Connector and Icon	Pin	Signal
	1	Data
	2	Ground

Parallel Interface

Connector and Icon



Pin	Signal	Pin	Signal
1	Strobe	10	Acknowledge
2	Data Bit 0	11	Busy
3	Data Bit 1	12	Paper End
4	Data Bit 2	13	Select
5	Data Bit 3	14	Auto Linefeed
6	Data Bit 4	15	Error
7	Data Bit 5	16	Initialize Printer
8	Data Bit 6	17	Select IN
9	Data Bit 7	18–25	Signal Ground

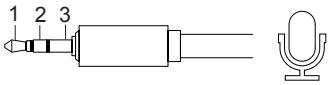
Serial Interface, Powered and Non-Powered

Connector and Icon	Pin	Signal
	1	Carrier Detect (12V if powered)
	2	Receive Data
	3	Transmit Data
	4	Data Terminal Ready
	5	Signal Ground
	6	Data Set Ready
	7	Request to Send
	8	Clear to Send
	9	Ring Indicator (5V if powered)

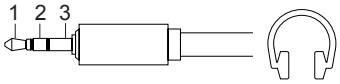
USB

Connector and Icon	Pin	Signal
	1	+5 VDC
	2	- Data
	3	+ Data
	4	Ground

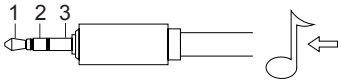
Microphone

Connector and Icon (1/8” miniphone)	Pin	Signal
	1 (Tip)	Audio_left
	2 (Ring)	Audio_Right
	3 (Shield)	Ground

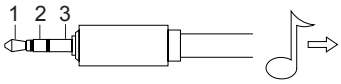
Headphone

Connector and Icon (1/8” miniphone)	Pin	Signal
	1 (Tip)	Audio_left
	2 (Ring)	Power_Right
	3 (Shield)	Ground

Line-in Audio

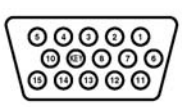
Connector and Icon (1/8” miniphone)	Pin	Signal
	1 (Tip)	Audio_In_Left
	2 (Ring)	Audio_In_Right
	3 (Shield)	Ground

Line-out Audio

Connector and Icon (1/8” miniphone)	Pin	Signal
	1 (Tip)	Audio_Out_Left
	2 (Ring)	Audio_Out_Right
	3 (Shield)	Ground

Monitor

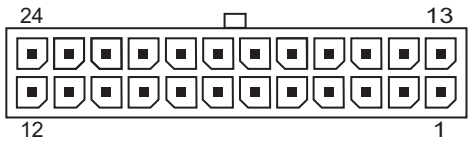
Connector and Icon



Pin	Signal	Pin	Signal
1	Red Analog	9	+5V (fused)
2	Green Analog	10	Ground
3	Blue Analog	11	Not used
4	Not used	12	DDC Serial Data
5	Ground	13	Horizontal Sync
6	Ground	14	Vertical Sync
7	Ground	15	DDC Serial Clock
8	Ground		

24-Pin Power

Connector



Front

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+3.3V	7	GND	13	+3.3V	19	GND
2	+3.3V	8	POK	14	–12V	20	open
3	GND	9	+5 Vaux	15	GND	21	+5V
4	+5V	10	+12V	16	PSON	22	+5V
5	GND	11	+12V	17	GND	23	+5V
6	+5V	12	+3.3V	18	GND	24	GND

PCI Express

x1, x4, x8, and x16 PCI Express Connector

Pin A

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	PRSNT1	6	JTAG3	11	PERST#	16	PERp0	21	PERp1
2	+12V	7	JTAG4	12	GND	17	PERn0	22	PERn1
3	+12V	8	JTAG5	13	REFCLK+	18	GND	23	GND
4	GND	9	+3.3V	14	REFCLK-	19	RSVD	24	GND
5	JTAG2	10	+3.3V	15	GND	20	GND	25	PERp2
26	PERn(2)	31	GND	36	PERn4	41	GND	46	GND
27	GND	32	RSVD	37	GND	42	GND	47	PERp7
28	GND	33	RSVD	38	GND	43	PERp6	48	PERn7
29	PERp3	34	GND	39	PERp5	44	PERn6	49	GND
30	PERn3	35	PERp4	40	PERn5	45	GND	50	RSVD
51	GND	56	PERp9	61	PERn10	66	GND	71	GND
52	PERp8	57	PERn9	62	GND	67	GND	72	PERp13
53	PERN8	58	GND	63	GND	68	PERp12	73	PERn13
54	GND	59	GND	64	PERp11	69	PERn12	74	GND
55	GND	60	PERp10	65	PERn11	70	GND	75	GND
76	PERp14	81	PERn15						
77	PERn14	82	GND						
78	GND								
79	GND								
80	PERp15								

Pin B information is on the next page

NOTE: x1 PCI Express uses pins 1-18

x4 PCI Express uses pins 1-32

x8 PCI Express uses pins 1-49

x16 PCI Express uses pins 1-8

PCI Express

x1, x4, x8, and x16 PCI Express Connector

Pin B

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+12V	6	SMDAT	11	WAKE#	16	GND	21	GND
2	+12V	7	GND	12	RSVD	17	GND	22	GND
3	RSVD	8	+3.3 V	13	GND	18	PETp1	23	PETp2
4	GND	9	JTAG1	14	PETp0	19	PETn1	24	PETn2
5	SMCLK	10	3.3vAux	15	PETn0	20		25	GND
26	GND	31	PRSNT2#	36	GND	41	PETp6	46	PETn7
27	PETp3	32	GND	37	PETp5	42	PRTn6	47	GND
28	PETn3	33	PETp4	38	PETn5	43	GND	48	PRSNT2#
29	GND	34	PETn4	39	GND	44	GND	49	GND
30	RSVD	35	GND	40	GND	45	PETp7	50	PETp8
51	PETn8	56	GND	61	GND	66	PETp12	71	PETn13
52	GND	57	GND	62	PETp11	67	PETn12	72	GND
53	GND	58	PETp10	63	PETn11	68	GND	73	GND
54	PETp9	59	PETn10	64	GND	69	GND	74	PETp14
55	PETn9	60	GND	65	GND	70	PETp13	75	PETn14
76	GND	81	PRSNT2#						
77	GND	82	RSVD						
78	PETp15								
79	PETn15								
80	GND								

Pin B information is on the next page

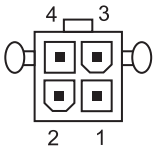
NOTE: x1 PCI Express uses pins 1-18

x4 PCI Express uses pins 1-32

x8 PCI Express uses pins 1-49

x16 PCI Express uses pins 1-8

4-Pin Power (for CPU)

Connector and Icon	Pin	Signal
	1	GND
	2	GND
	3	+12V CPU
	4	-12V CPU

B Power Cord Set Requirements

The power supplies on some computers have external power switches. The voltage select switch feature on the computer permits it to operate from any line voltage between 100-120 or 220-240 volts AC. Power supplies on those computers that do not have external power switches are equipped with internal switches that sense the incoming voltage and automatically switch to the proper voltage.

The power cord set received with the computer meets the requirements for use in the country where you purchased the equipment.

Power cord sets for use in other countries must meet the requirements of the country where you use the computer.

General Requirements

The requirements listed below are applicable to all countries:

1. The power cord must be approved by an acceptable accredited agency responsible for evaluation in the country where the power cord set will be installed.
2. The power cord set must have a minimum current capacity of 10A (7A Japan only) and a nominal voltage rating of 125 or 250 volts AC, as required by each country's power system.
3. The diameter of the wire must be a minimum of 0.75 mm_2 or 18AWG, and the length of the cord must be between 1.8 m (6 feet) and 3.6 m (12 feet).

The power cord should be routed so that it is not likely to be walked on or pinched by items placed upon it or against it. Particular attention should be paid to the plug, electrical outlet, and the point where the cord exits from the product.

⚠ **WARNING!** Do not operate this product with a damaged power cord set. If the power cord set is damaged in any manner, replace it immediately.

Japanese Power Cord Requirements

For use in Japan, use only the power cord received with this product.

△ **CAUTION:** Do not use the power cord received with this product on any other products.

Country-Specific Requirements

Additional requirements specific to a country are shown in parentheses and explained below.

Country	Accrediting Agency	Country	Accrediting Agency
Australia (1)	EANSW	Italy (1)	IMQ
Austria (1)	OVE	Japan (3)	METI
Belgium (1)	CEBC	Norway (1)	NEMKO
Canada (2)	CSA	Sweden (1)	SEMKO
Denmark (1)	DEMKO	Switzerland (1)	SEV
Finland (1)	SETI	United Kingdom (1)	BSI
France (1)	UTE	United States (2)	UL
Germany (1)	VDE		

1. The flexible cord must be Type HO5VV-F, 3-conductor, 0.75mm_2 conductor size. Power cord set fittings (appliance coupler and wall plug) must bear the certification mark of the agency responsible for evaluation in the country where it will be used.
2. The flexible cord must be Type SVT or equivalent, No. 18 AWG, 3-conductor. The wall plug must be a two-pole grounding type with a NEMA 5-15P (15A, 125V) or NEMA 6-15P (15A, 250V) configuration.
3. Appliance coupler, flexible cord, and wall plug must bear a “T” mark and registration number in accordance with the Japanese Dentori Law. Flexible cord must be Type VCT or VCTF, 3-conductor, 0.75 mm_2 conductor size. Wall plug must be a two-pole grounding type with a Japanese Industrial Standard C8303 (7A, 125V) configuration.

C Troubleshooting

Safety and Comfort

⚠ **WARNING!** Misuse of the computer or failure to establish a safe and comfortable work environment may result in discomfort or serious injury. Refer to the *Safety & Comfort Guide* available on the Web site at http://www.hp.com/ergo for more information on choosing a workspace and creating a safe and comfortable work environment.

WARNING! Energized and moving parts inside.

Disconnect power to the equipment before removing the enclosure.

Replace and secure the enclosure before re-energizing the equipment.

Before You Call for Technical Support

If you are having problems with the computer, try the appropriate solutions below to try to isolate the exact problem before calling for technical support.

- Run the HP diagnostic tool.
- Run the hard drive self-test in Computer Setup. Refer to the *Computer Setup (F10) Utility Guide* for more information.
- Listen for a series of beeps from the computer. The beeps are error codes that will help you diagnose the problem. Refer to Interpreting POST Diagnostic Front Panel LEDs and Audible Codes on page 143 to interpret the codes.
- If the screen is blank, plug the monitor into a different video port on the computer if one is available. Or, change out the monitor with a monitor that you know is functioning properly.
- If you are working on a network, plug another computer with a different cable into the network connection. There may be a problem with the network plug or cable.
- If you recently added new hardware, remove the hardware and see if the computer functions properly.
- If you recently installed new software, uninstall the software and see if the computer functions properly.
- Boot the computer to the Safe Mode to see if it will boot without all of the drivers loaded. When booting the operating system, use “Last Known Configuration.”
- Refer to the comprehensive online technical support at http://www.hp.com/support.
- Refer to Helpful Hints on page 138 in this guide for more general suggestions.

To assist you in resolving problems online, HP Instant Support Professional Edition provides you with self-solve diagnostics. If you need to contact HP support, use HP Instant Support Professional Edition's online chat feature. Access HP Instant Support Professional Edition at: http://www.hp.com/go/ispe.

Access the Business Support Center (BSC) at http://www.hp.com/go/bizsupport for the latest online support information, software and drivers, proactive notification, and worldwide community of peers and HP experts.

If it becomes necessary to call for technical assistance, be prepared to do the following to ensure that your service call is handled properly:

- Be in front of your computer when you call.
- Write down the computer serial number and product ID number, and the monitor serial number before calling.
- Spend time troubleshooting the problem with the service technician.
- Remove any hardware that was recently added to your system.
- Remove any software that was recently installed.

NOTE: For sales information and warranty upgrades (Care Packs), call your local authorized service provider or dealer.

Helpful Hints

If you encounter problems with the computer, monitor, or software, see the following list of general suggestions before taking further action:

- Check that the computer and monitor are plugged into a working electrical outlet.
- Check to see that the voltage select switch (some models) is set to the appropriate voltage for your region (115V or 230V).
- Check to see that the computer is turned on and the power light is on.
- Check to see that the monitor is turned on and the green monitor light is on.
- Turn up the brightness and contrast controls of the monitor if the monitor is dim.
- Press and hold any key. If the system beeps, then the keyboard should be operating correctly.
- Check all cable connections for loose connections or incorrect connections.
- Wake the computer by pressing any key on the keyboard or pressing the power button. If the system remains in suspend mode for more than four seconds, shut down the computer by pressing and holding the power button for at least four seconds then press the power button again to restart the computer. If the system will not shut down, unplug the power cord, wait a few seconds, then plug it in again. The computer will restart if automatic start on power loss is set in Computer Setup. If it does not restart, press the power button to start the computer.
- Reconfigure your computer after installing a non–plug and play expansion board or other option.
- Be sure that all the needed device drivers have been installed. For example, if you are using a printer, you need a driver for that model printer.
- Remove all bootable media (diskette, CD, or USB device) from the system before turning it on.

- If you have installed an operating system other than the factory-installed operating system, check to be sure that it is supported on the system.
- If the system has multiple video sources (embedded, PCI, or PCI-Express adapters) installed and a single monitor, the monitor must be plugged into the monitor connector on the source selected as the primary VGA adapter. During boot, the other monitor connectors are disabled and if the monitor is connected into these ports, the monitor will not function. You can select which source will be the default VGA source in Computer Setup.

△ **CAUTION:** When the computer is plugged into an AC power source, there is always voltage applied to the system board. You must disconnect the power cord from the power source before opening the computer to prevent system board or component damage.

Solving General Problems

You may be able to easily resolve the minor problems described in this section. If a problem persists and you are unable to resolve it yourself or if you feel uncomfortable about performing the operation, contact your HP authorized reseller or service provider.

Computer will not turn on.

Cause	Solution
Cables to the external power source are unplugged.	Ensure that cables connecting the computer to the external power source are plugged in properly and the wall outlet is active.
Voltage selector switch on rear of computer chassis (some models) not switched to correct line voltage (115V or 230V).	Select the proper AC voltage using the selector switch.
A defective PCI card has been installed.	Remove any expansion board that was just installed.
Drive data or power supply cables may not be properly connected.	Reseat drive data and power supply cables.
The unit temperature was exceeded. The fan may be blocked.	1. Unit is in an exceedingly hot environment. Let it cool down. 2. Ensure that computer air vents are not blocked and the internal fan is running. 3. Contact an HP authorized reseller or service provider.

Computer appears locked up and will not turn off when the power button is pressed.

Cause	Solution
Software control of the power switch is not functional.	1. Press and hold the power button for at least four seconds until the computer turns off. 2. Disconnect the power cord from the electrical outlet.

Computer will not respond to USB keyboard or mouse.

Cause	Solution
System has locked up.	Restart computer.
Keyboard or mouse is not connected to computer.	Connect keyboard and mouse cables to computer.
Computer is in **standby** mode.	To resume from **standby** mode, press the power button or press any key. **CAUTION:** When attempting to resume from **standby** mode, do not hold down the power button for more than four seconds. Otherwise, the computer will shut down and you will lose any unsaved data.

Computer date and time display is incorrect.

Cause	Solution
RTC (real-time clock) battery may need to be replaced. **NOTE:** Connecting the computer to a live AC outlet prolongs the life of the RTC battery.	First, reset the date and time under **Control Panel** (Computer Setup can also be used to update the RTC date and time). If the problem persists, replace the RTC battery. See the *Hardware Reference Guide* for instructions on installing a new battery, or contact an authorized dealer or reseller for RTC battery replacement.

Cursor will not move using the arrow keys on the keypad.

Cause	Solution
The Num Lock key may be on.	Press the Num Lock key. The Num Lock light should not be on if you want to use the arrow keys. The Num Lock key can be disabled (or enabled) in Computer Setup.

Poor performance is experienced.

Cause	Solution
Processor is hot.	1. Make sure airflow to the computer is not blocked. Leave a 10.2-cm (4-inch) clearance on all vented sides of the computer and above the monitor to permit the required airflow. 2. Make sure fans are connected and working properly (some fans only operate when needed). 3. Make sure the processor heatsink is installed properly.
Hard drive is full.	Transfer data from the hard drive to create more space on the hard drive.
Low on memory.	Add more memory.

Poor performance is experienced.

Cause	Solution
Hard drive fragmented.	Defragment hard drive.
Program previously accessed did not release reserved memory back to the system.	Restart the computer.
Virus resident on the hard drive.	Run virus protection program.
Too many applications running.	1. Close unnecessary applications to free up memory. Some applications run in the background and can be closed by right-clicking on their corresponding icons in the task tray. To prevent these applications from launching at startup, go to **Start** > **Run** (Microsoft Windows XP) or **Start** > **All Programs** > **Accessories** > **Run** (Microsoft Windows Vista) and type `msconfig`. On the **Startup** tab of the System Configuration Utility, uncheck applications that you do not want to launch automatically. **CAUTION:** Do not prevent applications from launching at startup that are required for proper system operation. 2. Add more memory.
Some software applications, especially games, are stressful on the graphics subsystem	1. Lower the display resolution for the current application or consult the documentation that came with the application for suggestions on how to improve performance by adjusting parameters in the application. 2. Add more memory. 3. Upgrade the graphics solution.
Cause unknown.	Restart the computer.

Blank screen (no video).

Cause	Solution
Monitor is not turned on and the monitor light is not on.	Turn on the monitor and check that the monitor light is on.
The cable connections are not correct.	Check the cable connection from the monitor to the computer and to the electrical outlet.
You may have a screen blanking utility installed or energy saver features are enabled.	Press any key or click the mouse button and, if set, type your password.
Computer is in **standby** mode.	Press the power button to resume from **standby** mode. **CAUTION:** When attempting to resume from **standby** mode, do not hold down the power button for more than four seconds. Otherwise, the computer will shut down and you will lose any unsaved data.

Blank screen (no video).

Cause	Solution
You are using a fixed-sync monitor and it will not sync at the resolution chosen.	Be sure that the monitor can accept the same horizontal scan rate as the resolution chosen.
Monitor cable is plugged into the wrong connector.	Ensure that the monitor is plugged into an active connector on the rear of the computer. If another connector is available, connect the monitor to that connector and reboot the system.
Bad monitor.	Try a different monitor.

Computer is beeping and will not start.

Cause	Solution
Internal error has occurred and the computer is beeping a code.	Refer to Interpreting POST Diagnostic Front Panel LEDs and Audible Codes on page 143 to interpret the error code.

Solving Hardware Installation Problems

You may need to reconfigure the computer when you add or remove hardware, such as an additional drive or expansion card. If you install a plug and play device, the Windows operating system automatically recognizes the device and configures the computer. If you install a non–plug and play device, you must reconfigure the computer after completing installation of the new hardware. In the Windows operating system, use the **Add Hardware Wizard** and follow the instructions that appear on the screen.

⚠ **WARNING!** When the computer is plugged into an AC power source, voltage is always applied to the system board. To reduce the risk of personal injury from electrical shock, rotating fans, and/or hot surfaces, be sure to disconnect the power cord from the wall outlet and allow the internal system components to cool before touching.

Look for the LED on the system board. If the LED is illuminated, the system still has power. Power off the computer and remove the power cord before proceeding.

A new device is not recognized as part of the system.

Cause	Solution
Device is not seated or connected properly.	Ensure that the device is properly and securely connected and that pins in the connector are not bent down.
Cable(s) of new external device are loose or power cables are unplugged.	Ensure that all cables are properly and securely connected and that pins in the cable or connector are not bent down.
Power switch of new external device is not turned on.	Turn off the computer, turn on the external device, then turn on the computer to integrate the device with the computer system.
When the system advised you of changes to the configuration, you did not accept them.	Reboot the computer and follow the instructions for accepting the changes.

A new device is not recognized as part of the system.

Cause	Solution
A plug and play board may not automatically configure when added if the default configuration conflicts with other devices.	Use Windows Device Manager to deselect the automatic settings for the board and choose a basic configuration that does not cause a resource conflict. You can also use Computer Setup to reconfigure or disable devices to resolve the resource conflict.
USB ports on the computer are disabled in Computer Setup.	Enter Computer Setup (F10) and enable the USB ports.

Computer will not start.

Cause	Solution
Wrong memory modules were used in the upgrade or memory modules were installed in the wrong location.	1. Review the documentation that came with the system to determine if you are using the correct memory modules and to verify the proper installation. 2. Listen for beeps from the computer. See Interpreting POST Diagnostic Front Panel LEDs and Audible Codes on page 143 to determine possible causes. 3. If you still cannot resolve the issue, contact Customer Support.

Interpreting POST Diagnostic Front Panel LEDs and Audible Codes

This section covers the front panel LED codes as well as the audible codes that may occur before or during POST that do not necessarily have an error code or text message associated with them.

⚠ **WARNING!** When the computer is plugged into an AC power source, voltage is always applied to the system board. To reduce the risk of personal injury from electrical shock and/or hot surfaces, be sure to disconnect the power cord from the wall outlet and allow the internal system components to cool before touching.

NOTE: If you see flashing LEDs on a PS/2 keyboard, look for flashing LEDs on the front panel of the computer and refer to the following table to determine the front panel LED codes.

Recommended actions in the following table are listed in the order in which they should be performed.

Not all diagnostic lights and audible codes are available on all models.

Table C-1 Diagnostic Front Panel LEDs and Audible Codes

Activity	Beeps	Possible Cause	Recommended Action
Green Power LED On.	None	Computer on.	None

Table C-1 Diagnostic Front Panel LEDs and Audible Codes (continued)

Activity	Beeps	Possible Cause	Recommended Action
Green Power LED flashes every two seconds.	None	Computer in Suspend to RAM mode (some models only) or normal Suspend mode.	None required. Press any key or move the mouse to wake the computer.
CPU fan is weak (RPM < 1000) or not turning. A warning message is displayed along with a series of long beeps for five seconds, then the system shuts down.	2	Processor thermal protection activated: A fan may be blocked or not turning. OR The heatsink/fan assembly is not properly attached to the processor.	1. Ensure that the computer air vents are not blocked and the processor cooling fan is running. 2. Open hood, press power button, and see if the processor fan spins. If the processor fan is not spinning, make sure the fan's cable is plugged onto the system board header. Ensure the fan is fully/ properly seated and installed. 3. If fan is plugged in and seated properly, but is not spinning, then replace processor fan. 4. Reseat processor heatsink and verify that the fan assembly is properly attached. 5. Contact an authorized reseller or service provider.
Red Power LED flashes five times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	5	Pre-video memory error.	**CAUTION:** To avoid damage to the DIMMs or the system board, you must unplug the computer power cord before attempting to reseat, install, or remove a DIMM module. 1. Reseat DIMMs. 2. Replace DIMMs one at a time to isolate the faulty module. 3. Replace third-party memory with HP memory. 4. Replace the system board.
Red Power LED flashes six times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	6	Pre-video graphics error.	For systems with a graphics card: 1. Reseat the graphics card. 2. Replace the graphics card. 3. Replace the system board. For systems with integrated graphics, replace the system board.

Table C-1 Diagnostic Front Panel LEDs and Audible Codes (continued)

Activity	Beeps	Possible Cause	Recommended Action
Red Power LED flashes eight times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	8	System board failure or invalid ROM based on bad checksum.	1. Reflash the system ROM with the latest BIOS image. 2. Replace the system board.
System does not power on and LEDs are not flashing.	None	System unable to power on.	Press and hold the power button for less than 4 seconds. If the hard drive LED turns green, the power button is working correctly. Try the following: 1. Check that the voltage selector (some models), located on the rear of the power supply, is set to the appropriate voltage. Proper voltage setting depends on your region. 2. Replace the system board. OR Press and hold the power button for less than 4 seconds. If the hard drive LED does not turn on green then: 1. Check that the unit is plugged into a working AC outlet. 2. Open hood and check that the power button harness is properly connected to the system board. 3. Check that both power supply cables are properly connected to the system board.

Contacting Customer Support

For help and service, contact an authorized reseller or dealer. To locate a reseller or dealer near you, visit http://www.hp.com.

NOTE: If you take the computer to an authorized reseller, dealer, or service provider for service, remember to provide the setup and power-on passwords if they are set.

Refer to the number listed in the warranty or in the *Support Telephone Numbers* guide for technical assistance.

D Specifications

Microtower

Table D-1 Specifications

Desktop Dimensions		
Height	15.12 in	384 mm
Width	7.26 in	184.5 mm
Depth	15.83 in	402 mm
Approximate Weight	18.4 lb	8.34 kg
Temperature Range		
Operating (35C)	50° to 95°F	10° to 35°C
Nonoperating	-22° to 149°F	-30° to 65°C
Relative Humidity (noncondensing)		
Operating	10-90%	10-90%
Nonoperating (38.7°C max wet bulb)	5-95%	5-95%
Maximum Altitude (unpressurized)		
Operating	10,000 ft	3048 m
Nonoperating	30,000 ft	9144 m
NOTE: Operating temperature is derated 1.0° C per 300 m (1000 ft) to 2,286 m (7,5000 ft) above sea level; no direct sustained sunlight. Maximum rate of change is 7.5° C/Hr. The upper limit may be limited by the type and number of options installed.		
Heat Dissipation		
Maximum (standard PS)	1575 BTU/hr	397 kcal/hr
Typical (idle) (standard PS)	307 BTU/hr	77 kcal/hr
Maximum (85 plus PS)	290.435 BTU/hr	73.14 kcal/hr
Typical (idle) (85 plus PS)	158.33 BTU/hr	39.87 kcal/hr

Table D-1 Specifications (continued)

Power Supply	115V	230V
Operating Voltage Range (standard PS)	90-132 VAC	180-264 VAC
Operating Voltage Range (85 plus PS)	90-264 VAC	90-264 VAC
Rated Voltage Range (standard PS)	100-127 VAC	200-240 VAC
Rated Voltage Range (85 plus PS)	100-240 VAC	100-240 VAC
Rated Line Frequency	50-60 Hz	50-60 Hz
Standard PS Power Output	300W/250W	300W/250W
85 Plus PS Power Output	300W	300W
Standard PS Rated Input Current (maximum)[1]	8A @ 115 VAC	4A @ 230 VAC
85 Plus PS Rated Input Current (maximum)[2]	8A @ 115 VAC	4A @ 230 VAC

[1] The standard power supply utilizes a passive power factor corrected power supply. The power factor correction is present in the 230V operating mode only. This allows the system to pass the CE mark requirements for use in the countries of the European Union. This supply requires the use of an input voltage range select switch.

[2] The 85 Plus power supply utilizes an active power factor corrected power supply. This allows the system to pass the CE mark requirements for use in the countries of the European Union. The active power factor corrected power supply also has the added benefit of not requiring an input voltage range select switch.

Small Form Factor

Table D-2 Specifications

Desktop Dimensions		
Height	3.86 in	9.8 cm
Width	13.19 in	33.5 cm
Depth	15.23 in	38.7 cm
Approximate Weight	14.05 lb	6.51 kg
Temperature Range		
Operating	50° to 95°F	10° to 35°C
Nonoperating	-22° to 140°F	-30° to 60°C
NOTE: Operating temperature is derated 1.0° C per 300 m (1000 ft) to 2,286 m (7,500 ft) above sea level; no direct sustained sunlight. Maximum rate of change is 7.5° C/Hr. The upper limit may be limited by the type and number of options installed.		
Relative Humidity (noncondensing)		
Operating	10-90%	
Nonoperating (38.7°C max wet bulb)	10-95%	
Maximum Altitude (unpressurized)		
Operating	10,000 ft	3048 m
Nonoperating	30,000 ft	9144 m

Table D-2 Specifications (continued)

Power Supply	115V	230V
Operating Voltage Range[1]	90-140 VAC	180-264 VAC
Rated Voltage Range	100-127 VAC	200-240 VAC
Rated Line Frequency	50-60 Hz	50-60 Hz
Power Output	250 W	250 W
Rated Input Current (maximum)[1]	7A @ 100 VAC	3.5A @ 200 VAC

[1] This system utilizes a passive power factor corrected power supply. The power factor correction is present in the 230V operating mode only. This allows the system to pass the CE mark requirements for use in the countries of the European Union. This supply requires the use of an input voltage range select switch.

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